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ENDOMETRIAL FINDINGS IN FUNCTIONAL MENSTRUAL DISORDERS*

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SINCE 1931, we have studied the endometrium in cases of amenorrhea and uterine bleeding.¹

The reasons for making such an investigation have been outlined previously.² In this paper it is our desire to present a brief analysis of the findings and to make a few comments.

As a background against which we hope they may be comprehended clearly, the following statements already expressed may be repeated:

(1) Neither amenorrhea nor uterine bleeding is associated specifically with any one abnormality in function; all one can say is that either may be the result of defects in the ovarian and endometrial cycle. Their dependence on a common disorder is evidenced by the fact that in the individual they frequently and repeatedly alternate, too little bleeding after a while being followed with too much bleeding.

(2) All regular uterine bleeding is not menstruation in the full sense of the term; that is, bleeding following ovulation and corpus luteum formation. This has been demonstrated in the monkey by Corner⁴ and Hartman,⁶ and its application to the human being has been suggested by such observers as Novak.¹³

(3) The symptoms relative to the menstrual flow, i.e., amenorrhea, oligomenorrhea, menorrhagia, metrorrhagia, etc., do not reflect always the exact functional state of the ovary. To give an example of this paradox, amenorrhea may be pres-

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ent when there is a corpus luteum that persists and does not undergo normal regression as well as when there is no corpus luteum at all; in the first instance the catabolic phase is delayed, in the second instance the anabolic phase is incomplete.

In the study herewith presented there were 193 cases divided almost equally between amenorrhea (96) and uterine bleeding (97); in addition, for the purpose of comparison, 42 cases were selected in which the flow was apparently normal in frequency, duration, and amount, but the patients had been treated for obesity, dysmenorrhea, and sterility.

Every case included in the series was free of an organic lesion. The specimens of mucosa were taken by curettage a day or two before the

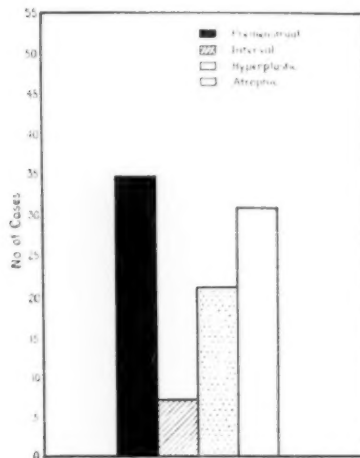


Fig. 1.

Fig. 1.—Endometrial findings in amenorrhea (96 cases). In the group as a whole there are all forms of amenorrhea and all types of endometria appear. The premenstrual and the atrophic types predominate, each comprising about one-third of the entire group.

Fig. 2.—Duration and type of amenorrhea group. The percentage of the atrophic type increases and the percentage of the premenstrual type decreases with the duration of the amenorrhea; in amenorrhea of three months or less a premenstrual mucosa is found in over three-fourths of the cases; in amenorrhea lasting from three months to one year, it is still somewhat more frequent than the atrophic mucosa; in amenorrhea of more than one year's duration the situation changes, the atrophic form becomes nearly twice as frequent as the premenstrual; in amenorrhea lasting over two years, a premenstrual form is found in only one of the cases and in amenorrhea of over three years, it is not found at all. It is noteworthy that a premenstrual endometrium is found in 4 out of 14 cases of amenorrhea lasting for more than one year, and, in one case, after cessation of the flow for almost three years.

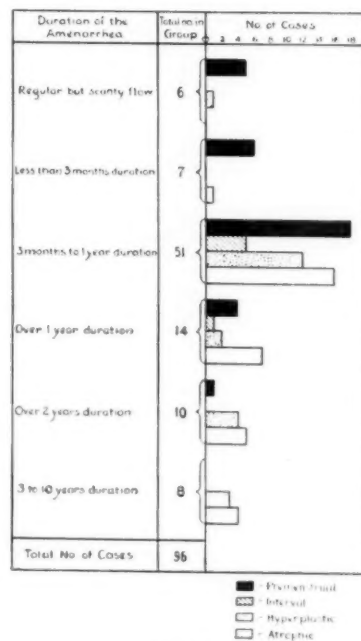


Fig. 2.

onset of a menstrual period. In many instances the date of an expected period was not easy to estimate; menstrual molimina and the cyclic appearance of the female sex hormone in the blood sometimes served as a guide; when there was no way of knowing, the curettage was per-

formed irrespective of the flow. In some instances, it was repeated once or twice during the course of the study.

The data are presented in Figs. 1 to 7. The endometrial findings have been classified as belonging to one of four groups: The premenstrual, the interval, the hyperplastic, and the atrophic types. In order to avoid a multiplicity of terms, when areas of hyperplasia were found in an interval or in an atrophic endometrium, the case was classified as one of hyperplasia; when they were found in a premenstrual endometrium, the case was classified as premenstrual. So that a local and especially a basal hyperplasia would not be overlooked, we chose a method of curettage that insured the recovery of endometrium from all parts of the uterine cavity. As the pipette or the suction curette secures only minute fragments of the superficial layers of the endo-

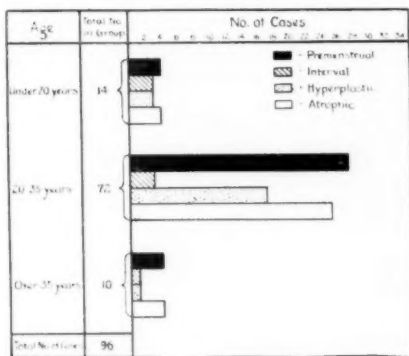


Fig. 3.

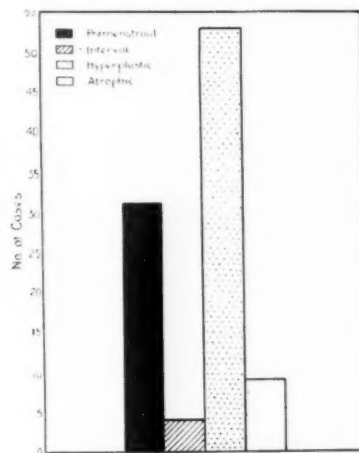


Fig. 4.

Fig. 3.—Amenorrhea, endometrial findings in the various age groups. The oldest patient is forty years, the youngest is sixteen years of age. Premenstrual changes appear in 4 women over 35, including one woman of forty; in the latter there are local areas of nonfunctioning endometrium. The premenstrual type tends to exceed the atrophic type during the reproductive period, as might be expected when sexual function is at its height.

Fig. 4.—Endometrial findings in bleeding group (97 cases). In the group as a whole there are all forms of uterine bleeding and all forms of endometriums: hyperplasia is found in more than one-half; the premenstrual type in about one-third. No definite association is observed between any one type of endometrium and any one type of bleeding, whether regular and profuse, frequent, continuous, etc.

metrium, many areas may be overlooked and deductions concerning the status of the mucosa may be erroneous.

Figs. 1 to 7 show that no constant relationship was found between menstrual disorders, whether amenorrhea or uterine bleeding, and the state of the ovarian function as reflected in the uterine mucosa. In explanation of this fact it may be said that while the anabolic phase of the ovarian and the uterine cycle is understood, our knowledge of the catabolic phase, especially as it is manifested in bleeding, is far from complete.

The work of Hitschmann and Adler,⁹ Schroeder,¹⁶ R. Meyer¹² and others, some time ago, correlating the cyclic changes in the ovaries and the uterus suggested the possibility that menstruation was a negative phenomenon due to a regression of the corpus luteum and its influence with a consequent desquamation of the endometrium. Confirmatory of this was the observation of Pratt who produced bleeding by the ablation of a functioning corpus luteum in the human being.

Corner's discovery of the anovular cycle, of "menstruation without ovulation," in the monkey cast doubt upon this conception. The difficulties of demonstrating the anovular cycle in the human being are evident. Novak suggests that it may occur fairly often but Shaw¹⁷ in a recent article, contends that such cases, if they occur at all, are quite exceptional, and bases his view upon a study of the ovaries and the uterus, or of the uterus (endometrium) alone of a group of regularly bleeding

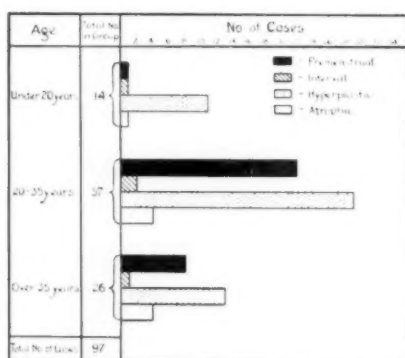


Fig. 5.



Fig. 6.

Fig. 5.—Uterine bleeding: endometrial findings in the various age groups. The oldest patient is fifty-one years, the youngest is fourteen years of age. Hyperplasia predominates throughout, especially in the adolescent group. The premenstrual type is found in over one-third of the cases in the reproductive period as against slightly less than one-third in the group over thirty-five years and only one-seventh in the group under twenty years of age. One woman forty-seven years old showed premenstrual changes in the mucosa.

Fig. 6.—Comparison of endometrial findings in amenorrhea and uterine bleeding. The symptoms associated with different types of mucosa are nearly equally divided between amenorrhea and uterine bleeding. The premenstrual and the interval groups show an almost equal proportion. In the hyperplastic group, there are two and one-half times as many cases of bleeding as of amenorrhea; in the atrophic group, there are three times as many cases of amenorrhea as of bleeding.

women; in all, he found evidence of corpus luteum activity between the fourteenth and the twenty-eighth day of the cycle.

Our findings seem to show very definitely that the anovular cycle does occur in the human being and point to a much higher incidence of anovular cycles in regularly bleeding women than Shaw thinks probable (9 out of 42, Fig. 7).

If regular bleeding is not always preceded with ovulation and regression of the corpus luteum, and in view of the absence of the corpus

luteum in uterine bleeding with hyperplasia, it is apparent that the cause of the bleeding which we may speak of as the bleeding factor or the bleeding mechanism is in doubt.

The situation may be reviewed under several heads:

A. *The Time Consumed by the Menstrual Cycle.*—As it is true that the menstrual cycle may be normal in all respects except in the time it consumes and the frequency of its recurrence, it is easy to be drawn into error relative to the estimation of an individual's function. Recent experimental and clinical evidence has led observers to question the classic view that the average healthy woman menstruates regularly at twenty-eight-day intervals.

Hartman⁷ observed in monkeys a marked irregularity of the flow and a wide variation of the bleeding interval between one animal and another as well as in the same animal at different times. In a recent article, he produces evidence pointing

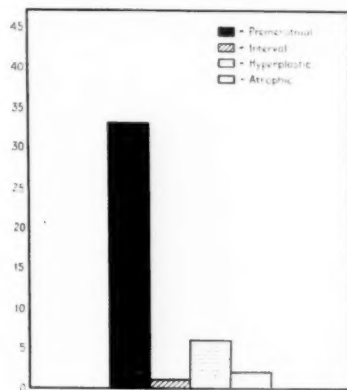


Fig. 7.—Endometrial findings with regular bleeding (42 cases) apparently normal menstruation. All types of endometria appear; the premenstrual type is found in over three-fourths of the cases; hyperplasia in about one-seventh of the cases.

to a prolongation of a corpus luteum phase of the cycle as the cause of the deviation from the average twenty-eight-day interval. He was able to demonstrate this by the rectal palpation method of ascertaining the ovulation time in monkeys; he found the length of the follicular phase fairly constant, that of the corpus luteum phase variable.

This observation bears out the suggestion noted in an earlier writing,¹ that the premenstrual changes found in some amenorrheic women may be due to a persistent corpus luteum, which is responsible in some way for the absence of the bleeding. This would apply especially to the cases in our series with periods of amenorrhea of short duration associated with a premenstrual endometrium. It might also explain the findings of Fluhmann⁵ and others, that the cycle of the human being, like that of the monkey is irregular and capable of wide variation. For example, Fluhmann, making an accurate record of the menstrual dates of a group of 76 women selected, because they said they menstruated

regularly, found that most of them were irregular. In no more than one-third did the cycles fall within a five-day range; of these only 5 showed successive regular cycles.

The patients with amenorrhea of short duration in our series exhibiting premenstrual changes in the mucosa may be explained on this basis, i.e., a prolongation of the lutein phase of the cycle, and the patients showing interval changes on the basis of a prolongation of the follicular phase.

The possibility that the cycle may be delayed seems to be illustrated by one of our cases. Bleeding had occurred regularly every two months for several years. Curettage performed before the expected bimonthly period revealed a premenstrual endometrium. Following treatment, bleeding occurred at regular monthly intervals for four months; curettage performed just before one of the expected monthly periods revealed interval changes, suggesting that the cycle in the interval of one month since the last preceding flow had not yet passed the follicular phase. The possible significance of this case so far as the mechanism of the bleeding is concerned will be discussed later.

B. The Occurrence of Ovulation.—There seems to be no constant relationship between uterine bleeding and ovulation as shown by the occurrence of conception in mated test monkeys. Working with macaques, Hartman noted that while some irregularly bleeding monkeys were fertile, some of the regularly bleeding animals were unable to conceive. This is in harmony with our findings in the human being.

C. Experimental Study of Uterine Bleeding.—If the previous conception of the catabolic phase must be discarded—with what reasonable theory may it be replaced? In an attempt to explain apparently inconsistent findings, Hartman⁸ and his associates sought to identify some distinct factor whose activity was responsible for the periodic flow. They repeatedly injected anterior pituitary substance into castrated monkeys: when the injections were stopped, bleeding would start; they also found that the withdrawal of injections of estrin in castrated monkeys produced bleeding but only when the hypophysis was intact; these findings seemed to point to some extraovarian bleeding factor.

Hartman's results with anterior pituitary substance were disputed by Saiki¹⁵ who was unable to produce bleeding with anterior pituitary substance unless the ovaries of the animal were intact. But Hartman's results with estrin injections were confirmed by Saiki as well as by other investigators.

Zuckerman¹⁹ has suggested that the observations relative to the effect of estrin fail to prove conclusively that bleeding is due to a withdrawal of this substance alone, and argues that since in the normal cycle, bleeding follows regression of

the corpus luteum, it, therefore, may be ascribed to a withdrawal of progestin as well as of estrin. That his criticism may be justified is suggested by the fact that the continued administration of progestin as well as of estrin postpones the onset of bleeding.

Of just as much theoretical and even more practical importance are the more recent reports of Kaufmann,¹⁰ of Loeser¹¹ and of Clauberg³ who were able, by the injection first of folliculin and then of progestin into castrated and primarily amenorrheic women, to produce a menstrual endometrium and bleeding. In evaluating these reports we must remember that a tremendous amount of hormone was used and that there were only a few cases.

D. Discussion of Evidence Relative to the Bleeding Factor.—As the results of experimentation in the hands of such expert observers do not wholly agree, we turn to the clinical side and there are confronted with several confusing facts; first, that although the normal menstrual flow is coincident with the regression of the corpus luteum, bleeding may occur independently when a corpus luteum has never formed; second, that even when there is a corpus luteum, the yellow body may persist and there may be no bleeding at all (amenorrhea); and third, that the administration of the hormonal products so far manufactured have a doubtful therapeutic influence in the human being.

We can scarcely avoid the conclusion, therefore, that there is some factor yet to be found in explanation of uterine bleeding. The experiments of Hartman, Saiki, Zuckerman and others noted above apparently indicate that anterior pituitary hormone, estrin and progestin play a part in the bleeding mechanism and that normally it is connected in some way with the catabolic phase of the cycle in the ovaries and the uterus but just how we do not know.

E. Clinical Facts Observed and Their Relation to Theories.—The case already referred to in the above paragraph in which the flow was regulated to monthly intervals while the ovarian and the endometrial changes continued at their wonted bimonthly pace can hardly be explained except on the basis of a positive influence for bleeding, a positive bleeding mechanism. While in some of our cases of amenorrhea of long duration in which premenstrual changes were observed, one might be satisfied with the theory that the cycle was lengthened, the occurrence of conception in one of these women despite the absence of the flow for long periods of time suggests that complete periodic anabolic changes including ovulation and corpus luteum formation may occur without being punctuated by the appearance of the flow. Here the bleeding mechanism, whatever it is, does not produce bleeding or does not act.

That the cycle may be shortened, that the bleeding mechanism may be independent of the usual premenstrual and menstrual changes in the endometrium, and that it may be overactive, producing bleeding two or

three times during the cycle instead of once, has been suggested by the findings of a premenstrual endometrium in many of our bleeding cases, not only just before a recurrence of the bleeding might have been expected, but in some cases during the bleeding, and in one as early as four days after the last bleeding.

The high incidence of hyperplasia in the bleeding group suggests that both the hyperplasia and the bleeding may be the result of a common cause. The view that hyperplasia may sometimes be due (exclusive of organic causes) to the continued stimulation of estrin elaborated by successive crops of atretic follicles in the absence of the periodic inhibiting influence of the corpus luteum, is interesting in this connection.

At present there seems to be no conclusive evidence relative to the bleeding mechanism.

CONCLUSIONS

1. In a study of 96 cases of amenorrhea, 97 cases of uterine bleeding and 42 cases of apparently normal menstruation treated for dysmenorrhea, sterility, and obesity, we have found no constant relationship between the clinical symptoms and the development of a premenstrual endometrium.

2. While the development of a premenstrual endometrium invariably coincides with ovulation and the development of a corpus luteum and our understanding of the anabolic cycle is complete, amenorrhea, uterine bleeding and what appears to be normal menstruation is associated with so many different states of the ovary that we cannot from our present knowledge understand the catabolic cycle.

3. Our clinical and laboratory findings seem to endorse the recent tendency in the literature to question:

- (a) The constancy of the relationship between the state of ovarian function and the periodicity of the flow;
- (b) The truth of the idea that most healthy women menstruate regularly and at twenty-eight-day intervals;
- (c) The validity of the view that menstrual bleeding depends upon a regression of the corpus luteum (negative phenomenon).

4. We believe that bleeding may be due to some positive mechanism, thus far unexplained.

5. As amenorrhea, oligomenorrhea and functional uterine bleeding of any sort are unreliable as positive indices of ovarian function, test curettage is important as a diagnostic procedure in the diagnosis and treatment of functional gynecologic disorders.

6. A correct evaluation of the uterine mucosa depends upon the recovery of mucosa from all parts of the uterine cavity. The use of a pipette curette seems inadequate for this purpose.

REFERENCES

- (1) *Anspach, B. M., and Hoffman, J.*: AM. J. OBST. & GYNEC. 24: 3, 1932.
 (2) *Idem*: AM. J. OBST. & GYNEC. 26: 147, 1933. (3) *Clauberg, C.*: Zentralbl. f. Gynäk. 57: 1461, 1933. (4) *Corner, G. W.*: Contrib. Embryol. (No. 75), Carnegie Inst. Wash. 15: 73, 1923. (5) *Fluhmann, C. F.*: AM. J. OBST. & GYNEC. 27: 73, 1934. (6) *Hartman, C. G.*: Contrib. Embryol., No. 154, pp. 1-161, 1932. (7) *Ibid.*: AM. J. OBST. & GYNEC. 26: 600, 1933. (8) *Hartman, C. G., Firor, W. M., and Geiling, E. M. M.*: Am. J. Physiol. 95: 662, 1930. (9) *Hitschmann and Adler*: Monatsschr. f. Geburtsh. u. Gynäk. 27: No. 1, 1908. (10) *Kaufmann, C.*: Zentralbl. f. Gynäk. 57: 42, 1933. (11) *Loeser, A.*: Ztschr. f. Geburtsh. u. Gynäk. 104: 516, 1933. (12) *Meyer, R., and Ruge, C.*: Zentralbl. f. Gynäk. 37: 50, 1913. (13) *Novak, E.*: J. A. M. A. 102: 452, 1934. (14) *Pratt, J. P.*: Endocrinology 15: 273, 1927. (15) *Saiki, S.*: Am. J. Physiol. 100: 8, 1932. (16) *Schroeder, R.*: Arch. f. Gynäk. 101: 1, 1914. (17) *Shaw, W.*: Brit. M. J. 1: 7, 1934. (18) *Smith, P. E., and Engle, E. T.*: Proc. Soc. Exper. Biol. & Med. 29: 1225, 1932. (19) *Zuckerman, S.*: Brit. M. J. 3754: 1093, 1932.

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DISCUSSION

DR. FRANKLIN L. PAYNE.—Under normal conditions the endometrium is constantly changing. In regularly menstruating women a characteristic picture is seen for each period of the menstrual cycle. Examination of a single specimen of endometrium taken at a given time during that cycle is sufficient. In the event of amenorrhea or menstrual irregularity, however, a single curettage is of little value in determining the endometrial changes. Study of specimens taken at regular intervals of seven to ten days for five to six weeks will permit accurate deductions as to the physiology of the endometrium.

While the technic of collection of these specimens has not yet been perfected, the nearest approach is the Burch endometrial suction cannula. This instrument is not to be used for diagnostic purposes, other than the collection of specimens for physiologic study. The chief objection to this cannula is the danger of striking a localized area of hyperplasia or some other condition which is not typical of the general endometrial picture. By shifting the cannula from place to place and taking several plugs of tissue at each sitting, this danger is eliminated.

It is possible that the number of interval atrophic endometria which Dr. Hoffman reports would have been reduced if he had obtained several specimens at regular intervals from each patient.

The personal element must play an important part in the diagnosis of hyperplasia. Dr. Graves reported over 90 per cent incidence in functional bleeding with metrorrhagia. Dr. Hoffman finds hyperplasia in 50 per cent of his cases of functional bleeding, while in a recent study we found only 23 per cent. The relationship between functional bleeding and hyperplasia is questionable. It is often seen in patients with perfectly normal periods; in fact, 8 per cent of the hyperplasias in our laboratory were associated with no menstrual abnormality. Occasionally we find this endometrial change in amenorrhea, in one instance of eight years' duration. Therefore, we believe that hyperplasia is a coincidental condition and not the causative factor in functional uterine hemorrhage. The variety of endometrial pictures seen in functional bleeding suggests that it is not a clinical entity, but a symptom of several different types of endocrine dysfunction, many of which reflect themselves in endometrial changes which we cannot distinguish from the normal.

FURTHER STUDIES ON THE PELVIC ARCHITECTURE*

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INTRODUCTION

IN A RECENT communication¹ we suggested a new classification of female pelves and described in considerable detail the anatomical characteristics of the four parent types, namely, the gynecoid, android, anthropoid, and flat (platypelloid) forms. This present investigation is based on a similar analysis of the pelvic form in 215 primigravid women admitted consecutively to the antepartum clinic of the Sloane Hospital for Women. This study has permitted us to evaluate the practical usefulness of the classification, to define more definitely the intermingling of types, to cite the frequency of occurrence of the various forms as classified, and to clarify certain other points of anatomical and obstetric interest.

METHODS OF STUDY

In each case a complete roentgenologic examination was obtained in the prenatal period through the cooperation of the Roentgen Ray Department of the Presbyterian Hospital. The technic used is similar to the method described in our original presentation¹ with one important modification. In order to avoid oblique inlet views in certain cases, we use routinely a thick lumbosacral pad for the stereoroentgenograms. This pad increases the lumbosacral angle and tilts the inlet to a position as nearly parallel to the film as is possible within practical limits. The stereoroentgenograms were viewed through the precision stereoscope.² Space will not permit a repetition of the optical principle involved, except to mention that the reconstructed image bears a true relationship in size and shape to the proportions which obtain in the living pelvis. By its use we have felt justified in estimating not only the size of the inlet but also the important diameters of the lower pelvis. We believe that the precision stereoscope is destined to form an essential part of the technic in pelvic radiography.

OBSERVATIONS

Even the inexperienced observer will encounter little difficulty in recognizing examples of the parent types, the gynecoid, android, anthro-

*Read at a meeting of the New York Obstetrical Society, March 13, 1934.

The authors wish to acknowledge their indebtedness to the artists, Mr. Alfred Feinberg and Miss Dorothy Sturm.

pooid, or flat forms. The intermediate forms may, however, afford difficulty unless their anatomical relationship to the parent types and a general conception of the factors which bring about the diversity of form observed in living women are clearly understood. We have considered it advisable to modify the classification as originally described in order to include the mixed types in their proper position with respect to the four large groups or parent forms. The complete classification as well as the frequency of occurrence of the individual types as found in this large series of cases is arranged as in Table I.

TABLE I

CLASSIFICATION	NO. OF CASES	INCIDENCE, PER CENT
1. True anthropoid type (see Fig. 1)	25	11.6
2. Anthropoid type with gynecoid tendency (see Fig. 2)	14	6.5
3. Gynecoid type with anthropoid tendency (see Fig. 3)	10	4.6
4. Gynecoid type with a narrow fore pelvis (see Fig. 4)	24	11.1
5. True gynecoid type (see Fig. 5)	85	39.5
6. Gynecoid type with flat tendency (see Fig. 6)	7	3.3
7. True flat (platypelloid) type (see Fig. 7)	2	0.9
8. Android type with anthropoid tendency (see Fig. 8)	8	3.7
9. Android type with gynecoid tendency (see Fig. 9)	11	5.1
10. True android type (see Fig. 10)	25	11.6
11. Android type with flat tendency (see Fig. 11)	4	1.8
12. Asymmetrical forms (see Fig. 12)	4	--

Since space will not permit a detailed anatomical description of each type, the reader is referred to the accompanying illustrations, Figs. 1 to 11, and to the original account of the four primary groups.¹ These illustrations were constructed around the tracing of the inlet from the roentgenogram and decreased to approximately life size through a study of the stereoscope image in the precision stereoscope.

In order to justify the increased complexity of the classification through the introduction of mixed terms, brief mention is made of the method of analysis used in typing the individual pelvises.

We have stated previously that the inlet is classified according to the shape of the posterior segment. Each true pelvic type has a corresponding typical fore pelvis associated with it. An intermingling of types occurs when a posterior segment of one of the four parent groups becomes associated with the fore pelvis of another. This intermingling of posterior and anterior segments of the primary groups is due to the fact that the pelvic girdle develops from seven distinct bone elements and any one element may unexpectedly display a radical departure in shape from the amplexness characteristic of the typical female form. For in-



Fig. 1.

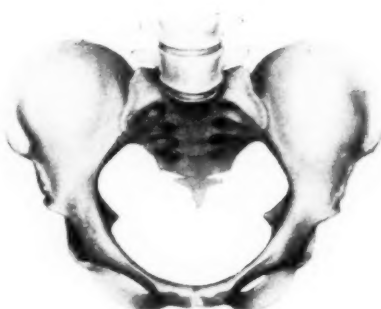


Fig. 2.

Fig. 1.—*The true anthropoid type of pelvis (parent type).*
 Note the long oval inlet. The anteroposterior diameter is long, the transverse is narrow. Study particularly the shape of the anterior segment (long and narrow) and posterior segment. In this pelvis the anthropoid influence predominates.

Fig. 2.—*The anthropoid type with gynecoid tendency (mixed type).*
 The pelvis is wider and shorter than the true anthropoid and in general appearance is a long broad oval. The posterior segment is anthropoid, the anterior segment more gynecoid in form.

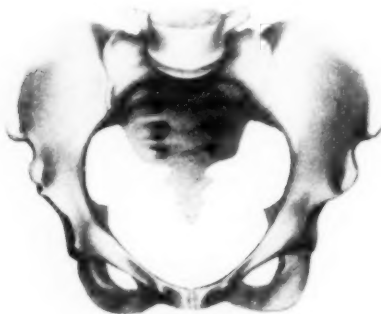


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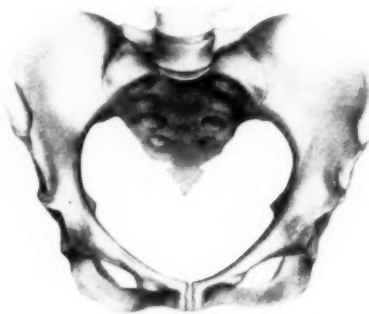


Fig. 4.

Fig. 3.—*The gynecoid type with anthropoid tendency (mixed type).*
 The posterior segment is gynecoid, the transverse diameter being closer to the promontory. The long, oval appearance is caused by the long, narrowed fore pelvis.

Fig. 4.—*The gynecoid type with a narrow fore pelvis (mixed type).*
 This pelvis is practically normal. The narrow fore pelvis is evidence of a weak anthropoid or male influence.

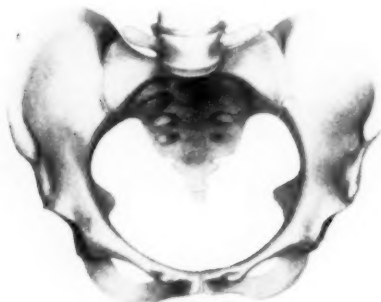


Fig. 5.

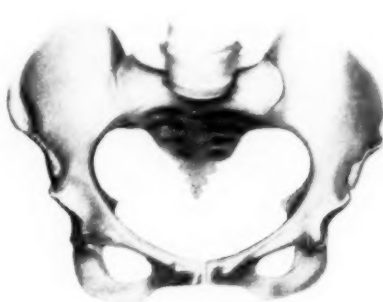


Fig. 6.

Fig. 5.—*The true gynecoid pelvis (parent type).*
 In the developmental cycle this inlet is round and typically female in all portions. The female influence predominates.

Fig. 6.—*The gynecoid type with a flat tendency (mixed type).*
 Note that the pelvis is wider and flatter, indicating a trend toward the true flat type.



Fig. 7.

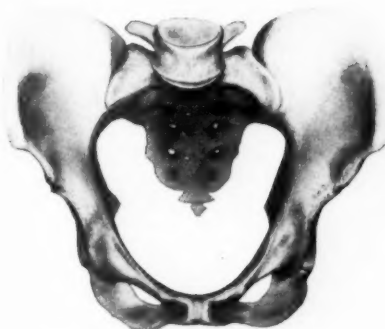


Fig. 8.

Fig. 7.—The flat (*platypelloid*) type (*parent type*).
The wide transverse and short anteroposterior diameter are the salient characteristics.

Fig. 8.—The android type with anthropoid tendency (*mixed type*).
The posterior segment conforms to the male type. The long oval appearance is caused by the long narrow fore pelvis. This places it also in the anthropoid class.

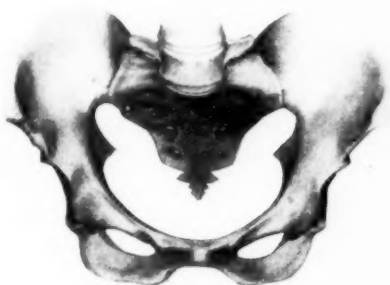


Fig. 9.

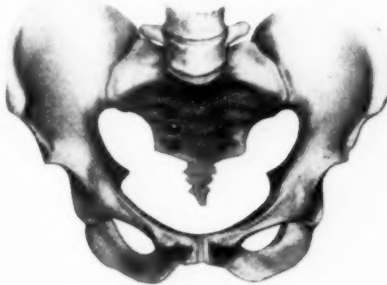


Fig. 10.

Fig. 9.—The android type with gynecoid tendency (*mixed type*).
The flat masculine posterior segment is characteristic and defines the pelvic type. The fore pelvis is gynecoid, similar to the fore pelvis seen in Fig. 5.

Fig. 10.—The true android type (*parent type*).
Note the flat male posterior segment, the narrow anterior segment, the forward sacrum and converging side walls. This pelvis approaches very closely the shape of the average male.

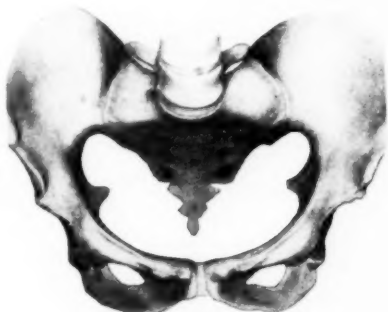


Fig. 11.



Fig. 12.

Fig. 11.—The android type with flat tendency (*mixed type*).

Although a male posterior pelvis is present, the general form is broad and flat.

Fig. 12.—The asymmetrical type.

The asymmetry is limited to the right side. The sacrosciatic notch is narrower on that side and the iliopectineal line is straighter.

stance, a pelvis may show a masculine posterior segment and a gynecoid fore pelvis. This is a mixed type and is classified as an "android pelvis with gynecoid tendency" (see Fig. 9).

A complete terminology for the individual pelvis must also include the lower pelvis. When a single term is used alone, as for instance a "gynecoid type," we infer that the lower pelvis is ample in all segments. When there occurs a significant departure from this ampleness in the lower pelvis such as a narrow subpubic angle, a forward sacrum or convergence of the side walls, each feature must be added separately in order to classify accurately the individual pelvis. As an example, let us suppose we have a pelvis which displays an anthropoid posterior segment with an ample fore pelvis and side walls converging to a narrow subpubic angle. This pelvis is classified as a "large, average, or small anthropoid pelvis with a gynecoid tendency and a narrow subpubic angle."

From a careful study of the illustrations in Figs. 1 to 11, the reader will observe a definite but gradual change which seems to follow what may be termed an evolutionary cycle. We refer to gradation of change from a long narrow oval characteristic of the anthropoid type (see Fig. 1) to the flat transverse oval of the flat or platypelloid type (see Fig. 7). This cycle of change may be more readily appreciated by reference to Fig. 13 on the left half of the outer circle. Beginning with the long narrow inlet and passing downward and to the left, the pelvis becomes broader transversely and shorter in the anteroposterior diameter. The fore pelvis becomes wider until ultimately the combined segments produce a round inlet characteristic of the gynecoid pelvis. The anthropoid influence is illustrated in the inner circle as the true anthropoid or "ape" pelvis.

Now, referring to the tabulated classification we have picked out three terms only to define this transition from the anthropoid to the gynecoid type: namely, the anthropoid type with gynecoid tendency, the gynecoid type with anthropoid tendency, and the gynecoid type with a narrow fore pelvis. In reality there are a great number of pelvises whose shape is such as to place them between these two parent groups. Below the round gynecoid inlet we find a continuation of this flattening which is characterized by a decrease in the anteroposterior diameter and an increase in the transverse until, eventually, the true flat pelvis is recognized (Fig. 7). As noted in the classification and as illustrated in Fig. 6, we have picked out one single pelvis, the "gynecoid pelvis with a flat tendency," to represent the gradation of change between the gynecoid and the flat forms. The flat influence is represented in the inner circle as the flat pelvic tendency. We believe that this cycle of change represents an evolutionary trend and forms one of the most significant observations in this present study.

Again referring to Fig. 13, the android forms may be noted in the right section of the outer circle. The term "android" is used to designate the female pelvis possessing a masculine type of posterior segment. This may likewise occur in any pelvis within the developmental cycle just described. Hence, we find *android pelvis with an anthropoid tendency*, *android pelvis with a gynecoid tendency*, the true android type, and, below this type as the flat form is approached, the *android pelvis with a flat tendency* (Figs. 8 to 11).

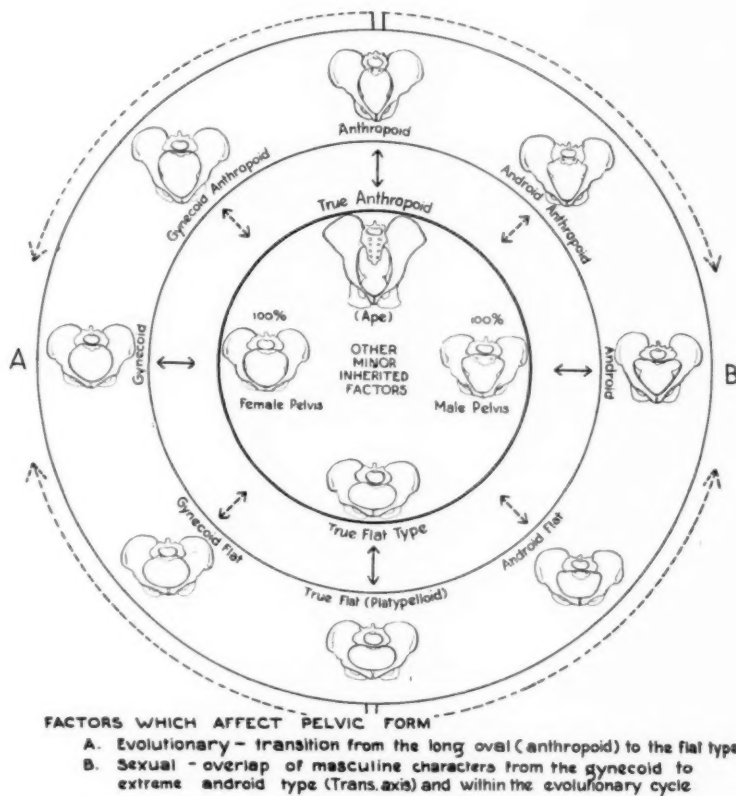


Fig. 13.—Diagrammatic illustration of the influences which affect the shape of the adult pelvis. The evolutionary factors are shown in the vertical series of the inner circle and the sexual or hormonal factors in the transverse series. The resulting living forms are illustrated in the outer circle.

Is it not possible that two great influences may be at work, one, the arrest in evolution from the ape form, the true anthropoid, to the perfect human form which is characteristically flat, and the other, a sexual or hormonal factor which may determine certain masculine characters in the female form?

If this is true, two distinct but radically different trends in pelvic shape result: evolutionary and sexual (hormonal). The evolutionary cycle has been described above. In Fig. 13 the evolutionary factor is

shown in the vertical series, the sexual or hormonal in the transverse series, and the mixed influences of both in the oblique series. With particular reference to the sexual (hormonal) influences at work, it is to be observed that in Fig. 13 the typical female pelvis which represents the female characteristics is placed in the inner circle opposite the true gynecoid form. Likewise, the typical male pelvis representing the masculine influence is placed opposite the true android forms. Thus we have all gradations in the overlapping of masculine characters from the typical gynecoid to the extreme true android pelvis. This latter form so closely approaches the appearance of the male that in the living subject the genital organs alone can designate the true sex of the individual.

While this reasoning is largely speculative, we have observed facts to substantiate such contentions. First, the importance of a hormonal influence either primary or secondary to an inherited control (gynecoid, android, anthropoid, or flat) is evidenced through the recognition of extreme types in the endocrine clinics in subjects suffering from an endocrine disturbance. These extreme forms are not commonly found on the obstetrical wards, although they do occur and increase markedly the incidence of operative deliveries. Second, the cycle of change which we have described above as evolutionary has been definitely observed through the stereoscope, and this interpretation seems obvious if one feels inclined to inquire into the possible causative factors.

In Fig. 12, a good example of an asymmetrical type is shown. Asymmetrical forms are rare. Only 4 in this series were classified as such, and of these 4 only one showed marked asymmetry. The general type will correspond to one of the 4 parent groups or intermediate forms.

We have referred to the fact that the lower pelvis may display in its component parts radical departures from the amplexness characteristic of the female form. It now becomes necessary to study these features which also include general pelvic size and to note the incidence of occurrence of the average shape as well as departures from this amplexness, and to relate their occurrence with respect to the four parent types.

Size of the Inlet.—The inlet, irrespective of the type, with regard to size is divided into large, average or small forms. In our series as a whole large pelves occurred in 25 per cent of the cases, average in 50 per cent, and 25 per cent of the pelves were below average size. This relationship was fairly well maintained in the gynecoid group except for a slight tendency toward fewer small pelves and more large forms. The android group, on the other hand, showed a significant increase in the small types, 44 per cent as compared to 28 per cent for the series. The anthropoid group revealed a tendency in the opposite direction toward a greater incidence of large pelves.

The Subpubic Angle.—The reader is referred to Fig. 14 A, B, and C, where wide, moderate, and narrow forms are illustrated as well as variations in the shape of the pubic arch and thickness of the bones.

The gynecoid group showed a decided preference for average or wide subpubic angles with a corresponding decrease in narrow angles when compared to the series. The android group showed a very definite tendency to the narrow forms, the incidence reaching 42 per cent as compared to 16 per cent for the series. The anthropoid pelvis revealed a larger incidence of wide angles, the narrow variety occurring in only 25 per cent of the cases. This was an unexpected finding. Anthropoid pelvises with narrow angles were not uncommon in Todd's skeletal ma-

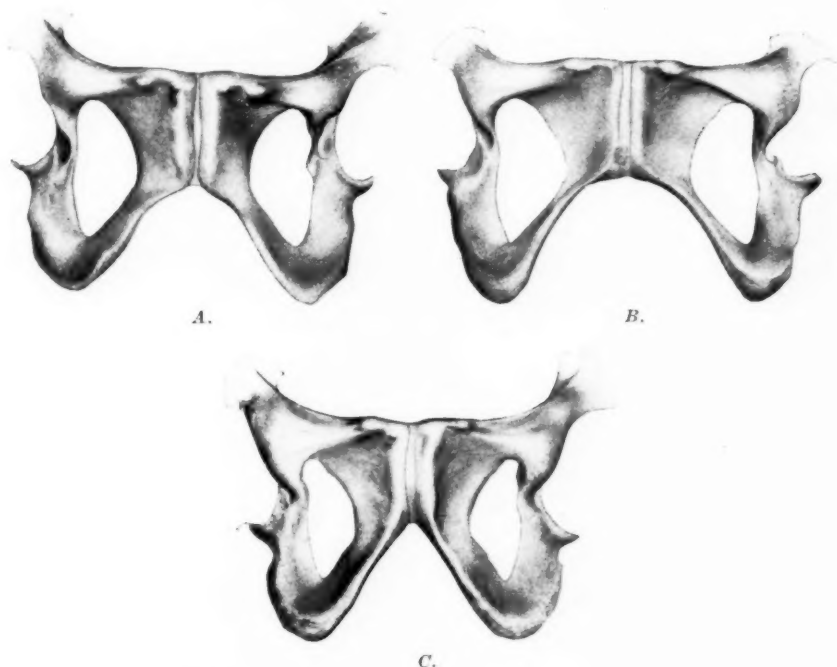


Fig. 14.—*The subpubic angle.*

A. The angle is wide in size. The bones are delicate. The pubic arch shows a marked Norman arch effect (extreme female).

B. The angle is moderate in size. The bones are average in thickness. The pubic arch shows an average curvature to the rami.

C. The angle is narrow. Note also the straight-edged pubic rami and thick bones indicative of an overlapping of the masculine characters.

terial. In living women this type of pelvis in all probability is found in the endocrine or sterility clinics rather than on the obstetrical wards.

The form of the pubic rami, whether straight or well curved, is of obstetric significance. Variations are frequently encountered but no correlation was found to exist with respect to the parent types.

Concerning the thickness of bones, we observed that narrow subpubic angles were associated with heavy bones in 32 per cent of the cases, while

wide arches and heavy bones were noted in 9 per cent. There is no significant correlation between width of the arch and light bones. Bone thickness is best studied from the roentgenogram of the subpubic angle. The only significant data with regard to bone thickness and pelvic type occurred in the android group. Heavy bones were noted in 34 per cent of these pelves as compared to 19 per cent for the series.

Narrow subpubic angles were associated with a narrow fore pelvis in 60 per cent of the cases, while wide arches showed narrow fore pelves in 42 per cent. In other words, the width of the pubic arch gives no clue to the size of the fore pelvis.

There is a marked relationship between the width of the arch and the splay of the side walls of the pelvis (see Fig. 15 *A* and *B*), narrow arches being associated with converging side walls in 100 per cent of the cases studied.

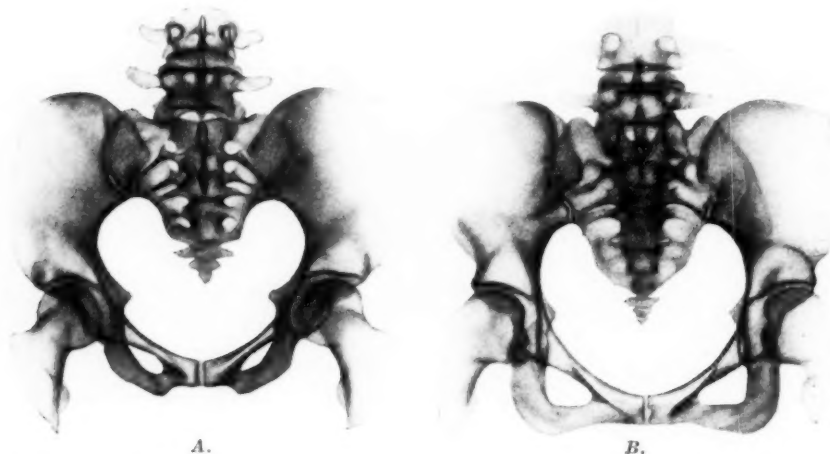


Fig. 15.—*Splay of side walls.**

A. The side walls converge or slope inward toward the narrow subpubic arch.

B. From the iliopectineal lines the side walls tend to diverge toward a wide subpubic angle. Note in this case the narrow fore pelvis.

No significant correlation was found to exist between the width of the subpubic angle and the sacrum. This is an important finding since Jareho,³ and in fact many obstetric authorities, have stressed the relationship of variations in the shape of Michaelis' rhomboid in abnormal pelves, among which is mentioned the funnel pelvis. In view of our findings it is to be observed that any variation in the shape of the rhomboid is caused by local variations in the shape of the sacrum or terminal iliac crests. The fore pelvis (pubis and ischium) is too far removed from the sacrum to be at all influenced morphologically by local sacral variations.

*The artist has used an original method of illustration. These figures are half-toned positive effects copied and modified from the x-ray negative.

Obstetric opinion has likewise associated assimilation, or the presence of six sacral segments, with variations in the subpubic angle. Assimilation was noted in 21 per cent of the cases of the entire series (see Figs. 17 *A*, *B*, and *C*). In the gynecoid group it occurred in 16 per cent, in the android in 27 per cent, with a slightly higher incidence in the anthropoid group, namely, 28 per cent. Six sacral segments were found associated with narrow subpubic angles twice as frequently as with wide angles. In spite of this, assimilation was noted in 16 per cent of the pelvises possessing wide angles. Williams⁴ and others have stressed the importance of assimilation in the causation of the so-called "funnel" pelvis. On the basis of the analysis of our series of cases, we do not hesitate to state that the so-called "funnel" pelvis as recognized by Williams refers to the masculine type of female pelvis or android forms in the great majority of the cases. That assimilation plays a very minor



Fig. 16.—The ischial spine.

A. The sharp spine. Note the narrow base and sharp apex.

B. The anthropoid type of spine. Note the blunt apex and broad ample base.

C. The gorilla spine. It appears as a bulge on the ischium. The apex is poorly defined. The base is broad and flat.

rôle, if any at all, in the causation of the narrow subpubic angle, is evidenced by the fact that we found a slightly higher incidence of assimilation in anthropoid pelvises. As noted above, in this series anthropoid pelvises were characterized by the high incidence of wide subpubic angles, with narrow forms occurring only in 2.5 per cent of the cases.

Splay of the Side Walls.—The term as used refers to the slope of the lateral walls of the pelvis from the iliopectineal line to the lower end of the ischial tuberosities and forward from this line to the anterior segment of the bony outlet. Three degrees may be recognized, two of which are shown in Fig. 15 *A* and *B*: convergent, straight, and divergent. When each group is compared to the series as a whole, the gynecoid group reveals practically the same incidence of convergent and divergent

side walls. The android group shows a marked increase in the number of convergent walls with a corresponding decrease in the straight and divergent forms. This finding agrees with certain anatomical peculiarities of the masculine type of fore pelvis. Android forms show the highest incidence of narrow subpubic angles, and there is a high correlation between the splay of the side walls and the width of the pubic arch.

The anthropoid group shows a relatively low incidence of convergent walls and a high incidence of divergent forms. This again fits in with the high incidence of wide subpubic angles found in the anthropoid group.

The Ischial Spines.—Ischial spines may be classified as anthropoid, average, or sharp. The anthropoid type is shallow with a very broad base closely simulating the ischial bulge of the gorilla. Two human types, sharp and anthropoid, and the spine of a gorilla are illustrated

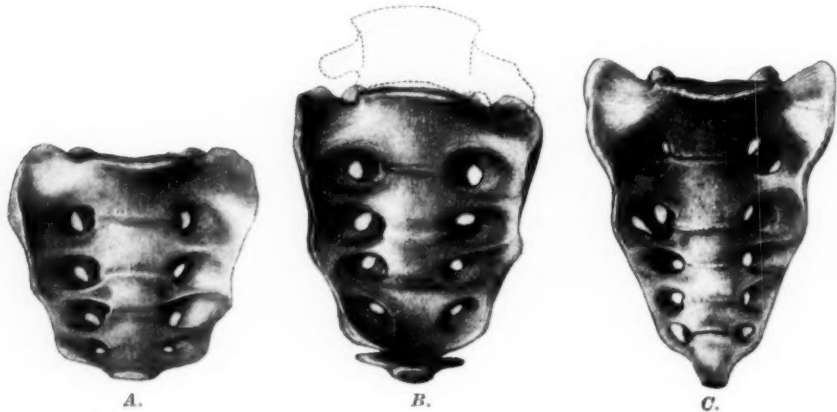


Fig. 17.—Types of sacra.

- A. The broad short type with five segments and a blunt tip.
- B. The average type with sacrococcygeal fusion and partial sacralization of the 5th lumbar, diagrammatically marked. The tip is rounded or average.
- C. The long narrow sacrum with a pointed dagger tip and six sacral segments. This shape is typically associated with the anthropoid type.

in Fig. 16 A, B, and C. The most common type of spine noted in the gynecoid group is the average form. The android group shows the greatest number of sharp spines. Since the android fore pelvis shows side walls which shape inward toward a narrow subpubic angle, it is conceivable that the sharp spines may further encroach on midpelvic space. Thus the high incidence of sharp spines in the android group becomes a significant obstetric factor. The anthropoid group shows the highest incidence of anthropoid spines and the lowest incidence of sharp spines.

Width of the Sacrum.—(Fig. 17 A, B, and C.) In the gynecoid group the sacrum is most commonly of average width. This is true also of the android group. In the anthropoid types, however, the number of

wide and average forms decrease, with a corresponding increase in the number of narrow sacra. In other words, the narrow type of sacrum is more characteristic of anthropoid pelves than the other groups, an observation which was primarily noted in skeletal material.

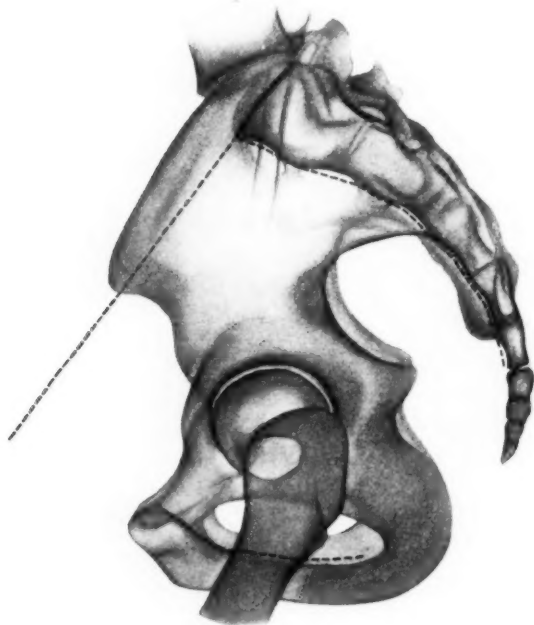
Shape of Terminal Sacrum.—(Fig. 17 A, B, and C.) The gynecoid group shows about the same incidence of blunt, average, and dagger-shaped sacra as the series as a whole. In the android group the blunt-tipped sacrum is more easily palpated than the rounded average tip or dagger form. Thus it becomes easier clinically to estimate the distance between the lower lateral border of the sacrum and the ischial spines in the android group because the spines are sharp and the lateral sacral edge is a prominent tubercle. This is a fortunate state since the posterior sagittal space is most significant obstetrically in the android types.

In the anthropoid group there is a decrease in the blunt sacra with a corresponding increase in the dagger forms. The dagger tip is characteristic of the long, narrow anthropoid type of sacrum.

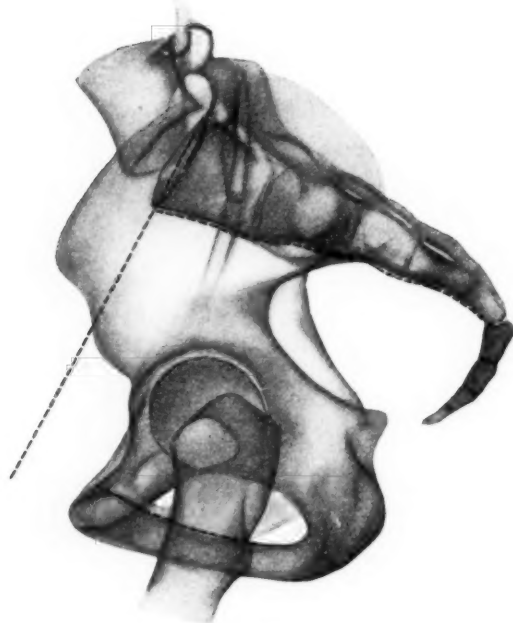
Curvature of the Sacrum.—(Fig. 18 A, B, and C.) The gynecoid group shows practically the same incidence of straight, average, and marked curvature as the series. The android group reveals a high incidence of straight sacra. In the anthropoid group the straight sacra are considerably decreased with a corresponding rise in the incidence of average sacra. They also show the highest incidence of sacra with marked curvature. Typical fishhook terminal curvatures are rare and usually occur in the straight types. The causative factor in all probability is traumatic in origin.

The Inclination of the Sacrum and the Lateral Bore.—(Fig. 18 A, B, and C.) The inclination of the sacrum may be divided into two forms: postural and fixed. In a consideration of the postural inclination, controlled as it is largely by the obliqueness of the pelvic inlet and the degree of curvature of the lumbosacral angle, the gynecoid group shows the highest incidence of the average type of inclination. In the android group the backward and average sacra decrease with a corresponding increase in the forward inclination. The incidence of forward sacra for the series is 22.5 per cent, while for the android group it is 33 per cent. There is nothing characteristic concerning the sacral inclination in the anthropoid group except for a slight increase in the backward forms.

The fixed inclination of the sacrum within the true pelvis, viewed from the lateral aspect in conjunction with the plane of the symphysis and the descending pubic rami, introduces the importance of the "lateral bore of the pelvis." The anterior segment of the bore, being dependent on the slope of the symphysis and pubic rami, is not as variable as the posterior aspect which is controlled by the inclination of the anterior surface of the sacrum in the true pelvis. When the sacrum is forward in the pelvis, we speak of a convergent bore; when parallel with the



A.



B.

Fig. 18.—*The lateral bore with the inclination and curvature of the sacrum.*

A. The plane of the anterior surface of the sacrum is forward, the planes of the symphysis and pubic rami slope inward. This produces a convergent bore. The sacrum presents an average curvature. A parallel line along the articular surface of the first sacrum passes considerably above the pubis.

B. The sacrum showing a straight anterior surface is also parallel with the symphysis. This is called a straight lateral bore. The plane of the articular surface of the first sacrum also passes above the pubis.

symphysis, the bore is straight; and when the sacrum slopes backward, the bore is divergent. These different positions are illustrated in Fig. 18 *A, B*, and *C*. While there is a high correlation between the postural inclination of the sacrum and the lateral bore, this does not hold in all cases. In 9.5 per cent of the cases we note a divergent bore with a forward sacrum, and in 5.6 per cent a convergent bore shows a backward postural inclination. Our series shows that the convergent bore is most common in the android group and the divergent bore in the anthropoid group. This observation has definite clinical importance. When a narrow subpubic angle and converging fore pelvis are recog-

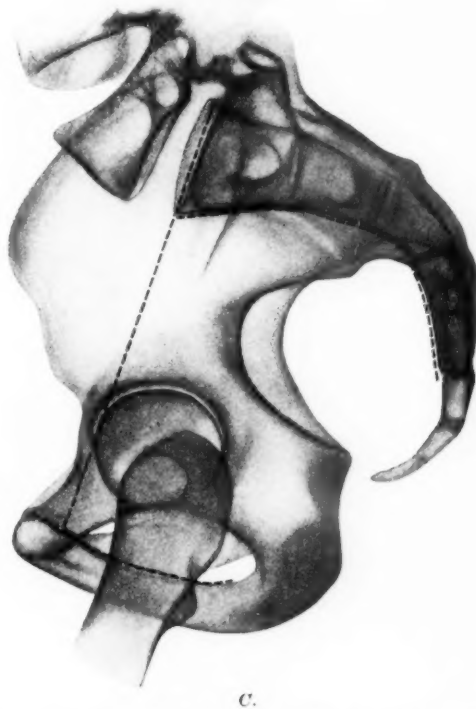


Fig. 18.—*C*. The sacrum showing an exaggerated curvature is inclined backward, producing a divergent bore in conjunction with the plane of the symphysis. The last lumbar is wedge-shaped. The sacrum is horizontal and the plane of the first sacral surface passes below the top of the pubis.

nized, the lower sacrum, particularly the distance between the ischial spine and lower sacral border, warrants careful examination. The possibility that the sacrum is inclined forward is greater in these android forms.

Physical Form Versus Pelvic Type.—(Fig. 19 *A, B*, and *C*.) An example of a woman possessing a true gynecoid pelvis is shown in Fig. 19 *A*. The shoulders are slightly narrower than the hips, or appear so. The waist measurement is narrow. The broad hips show a well-

rounded appearance from waistline to knees. The lower legs are slender. As a rule, the inner aspects of the thighs and knees are not approximated in the erect position.

The true anthropoid type as in Fig. 19 *B* shows wide muscular shoulders and narrow hips, the waistline being slightly thicker than in the true gynecoid type. The individuals are tall and slender, but short forms occur. Occasionally the legs are short, the torso long. As a rule, the legs are straight and slender, the inner aspects of thighs, knees, and lower legs being approximated.

The android type from the posterior aspect produces a square bodily appearance in relation to shoulders, waistline, and hips (Fig. 19 *C*).

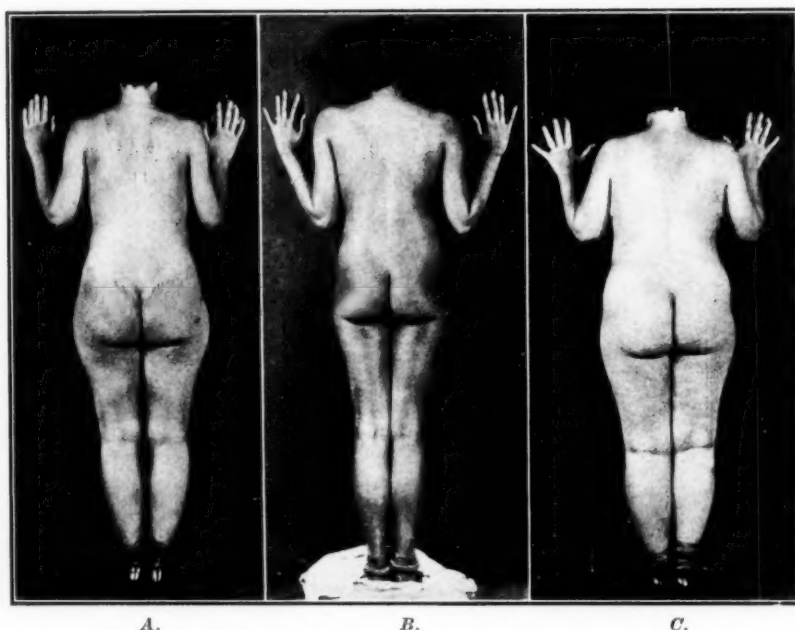


Fig. 19.—Physical form versus pelvic type.

A. The gynecoid type. Note the narrow shoulders and narrower waistline. The hips are broad. The lower legs are well curved and tend to be slender.

B. The anthropoid type. The shoulders are broad and the hips narrow. The legs are straight and slender.

C. The android type. Posteriorly the body is square. The waistline is thicker than in the other types. The legs are straight. The thickness of the thigh is preserved throughout the lower legs into the calves, the ankles, and the feet.

There is a tendency for the thick-set, short individual to predominate, although tall, muscular, heavy-boned types are found. The lower legs are thick and straight throughout. In the gynecoid type the thickness of the thighs ceases at the knees, but in the android this thickness continues into the calves, the ankles, and the feet.

Plane of First Sacral Articular Surface.—(Fig. 18 *A, B, and C.*) In the lateral view of the pelvis, a line drawn parallel to the articular surface of the first sacral surface passes approximately 7 cm. above the

top of the symphysis (Fig. 18 *A* and *B*). Occasionally, however, this line strikes below the top of the symphysis (Fig. 18 *C*). In these cases (8 per cent) a markedly curved horizontal sacrum with wedging of the fifth lumbar vertebra is always present (Fig. 18 *C*). In one case, not in this series, spondylolithiasis had occurred. The obstetric significance is not clear. The lumbosacral region becomes unstable mechanically and this entity may explain the severe lumbosacral pain noted occasionally in the postpartum period.

REFERENCES

- (1) *Caldwell, W. E., and Moloy, H. C.*: AM. J. OBST. & GYNEC. 26: 479, 1933.
(2) *Moloy, H. C.*: Am. J. Roentgenol. 30: 111, 1933. (3) *Jarcho, Julius*: The Pelvis in Obstetrics, New York, Paul B. Hoeber, Inc. (4) *Williams, J. W.*: Obstetrics, New York, 1930, D. Appleton & Company.

A NEW MEASUREMENT (CLINICAL) FOR ESTIMATING THE DEPTH OF THE TRUE PELVIS

(PRELIMINARY COMMUNICATION)

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ANYONE who has taken routine external pelvic measurements over a considerable period of time should early recognize the unfortunate fact that the information obtained is of extremely questionable value, so far as the obstetric prognosis is concerned. Without attempting to minimize the valuable contributions of Baudeloeque, Michaelis, and others, it is beginning to appear that the intereristal and interspinous diameters, and even the external conjugate, will soon be relegated to their place in classical obstetric lore. Pioneers in the newer methods of x-ray pelvimetry are now making clear their feeling with regard to orthodox pelvimetry. De Lee, in his textbook, states "the external ones (dimensions) are unreliable indices of the size of the pelvic cavity," and cites, as examples, pelvis in his possession where the external conjugate is entirely misleading compared with the length of the true conjugate. The old classification of pelvis is becoming less and less useful for clinical purposes, and the time has come when a more practical and rational classification will be necessary. To my mind, the greatest contribution to the study of the pelvis since Litzmann's classification in 1861, and rivalling the studies of Breus and Kolisko of this century, is the recent work of Caldwell and Moloy resulting in a suggested classification on a morphologic basis. No obstetrician can afford to neglect to familiarize himself with that important piece of research on the female pelvis, for I feel that their work will mark a definite milestone in ob-

stetric progress. It is not intended here to review their work; suffice it to say that the idea embodied in this communication was directly inspired by their paper.

My interest in the new classification began immediately upon reading the article. Here, apparently, was something that was going to clear up the haze surrounding that large group of pelvises, to all intents and purposes clinically normal, yet which prove obstetrically to be the very antithesis of normality. The android and anthropoid types of pelvises, so called by Caldwell and Moloy, which today constitute, in this country at least, a large proportion of our female pelvises, are certainly responsible for the many unanticipated dystocias—poor engagement, occiput posterior, transverse arrest, etc., that are experienced in everyone's practice. The male or funnel pelvis, whether or not associated with the D.D.S. type of individual, and the high assimilation pelvis have long

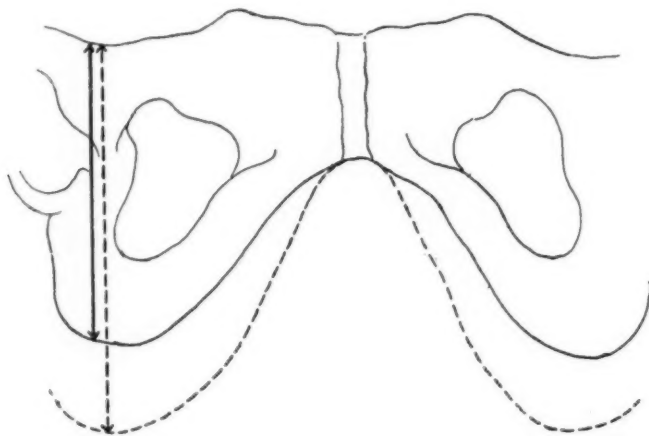


Fig. 1.—A diagram to show increased depth to the true pelvis. From this it can be seen that a deep (male) pelvis can be associated with a normal intertuberos diameter. (From Caldwell and Moloy.)

been recognized as a real or potential cause for dystocia. The criteria for such a diagnosis, however, have not been very reliable. Usually a narrow pubic arch, a diminished intertuberos diameter, sharp or prominent ischial spines, decreased anterior or posterior sagittal diameter, singly or together, correctly or not, have given us the key to the condition. The chief, and clinically the most important, characteristic of the male, funnel, or high assimilation pelvis, namely, its *increased depth*, has been left to guesswork, without a means of obtaining an accurate estimate by clinical methods. "The promontory seems high" or "the symphysis is high" represent the degree of accuracy to which we could attain in this important detail. Even x-ray pelvimetry, which has stressed the various diameters of the inlet, offers at present no measurement of pelvic depth.

The purpose of this paper is to call attention to the use of a new external measurement, based on the suggestions of Caldwell and Moloy, and intended to estimate the depth of the true pelvis. These authors recall the observation by Hart, who identified the "ischiopubic" type, which refers to the male characters in the fore pelvis, and the "ilio-sacral," which refers to those features in the posterior portion of the pelvis. Inasmuch as the anterior portion of the pelvis contains the most frequent and distinctive features found in the male or android type (for example, the triangular form of the inlet, narrow pubic arch, long pubic rami, etc.), it is logical to seek a measurement in the fore pelvis, which will give us an index to the most constant of the male characteristics,

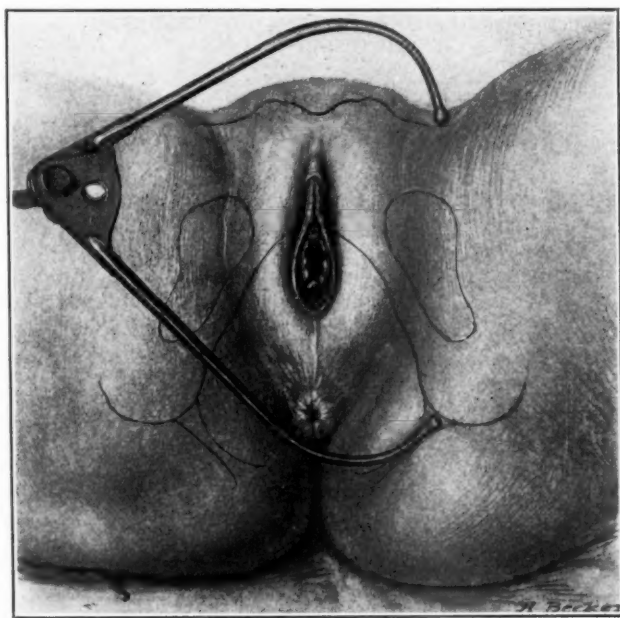


Fig. 2.—Method of measuring "pubotuberous" distance, giving depth of true pelvis. By means of the ordinary pelvimeter, it is clinically possible to detect an increase in the normal distance between the upper border of the superior ramus of the pubis (iliopectineal line) and the inner border of the inferior surface of the ischial tuberosity. Both sides may be measured.

that is, increased depth, and which is readily obtainable clinically. The suggestion as to the measurement best suited for this purpose was inspired by the reference in the much-mentioned article to Todd's skeletal material at the Western Reserve University. Todd measured the perpendicular distance from the tuberosity of the ischium to the iliopectineal line in 53 white male and 50 white female pelvis and found that for males this perpendicular averaged 101 mm. as compared with 90 mm. in the female.

With the above figures in mind, I began to take this measurement on women at every opportunity. This distance is easily measured by using

the ordinary pelvimeter. It is best taken immediately after the inter-tuberos diameter has been measured, and with one end of the pelvimeter still on the tuberosity, the other end is swung around until at a point on the upper border of the superior ramus of the pubis directly perpendicular to the tuberosity. One or both sides may be measured. I have found this distance to average 11.5 cm. Allowance must be made for pubic and gluteal fat; in the patient of normal build, 1 cm. should be allowed for soft parts, and in obese patients, 2 cm. Therefore, for the average patient, in whom you obtain a measurement of 11 cm., the true bony perpendicular will be 10. For the present, I shall call this diameter the "pubo tuberos" (right or left).

A few interesting cases where the measurement has been applied will serve to show its value.

An eighteen-year-old girl, whose average weight is 89 pounds, recently delivered without difficulty a baby weighing nearly 9 pounds. Her external conjugate is 17 cm. On her regular postdelivery visit, I took her pubo tuberos measurement, and found it to be only 9.5 cm., indicating a very shallow pelvis, conducive to an easy labor.

Recently, a para iv entered the obstetric clinic of the Sinai Hospital with an early pregnancy. Her first two labors ended in stillbirths, the third by elective cesarean section with good results. External measurements were all normal, on internal examination the sacrum and promontory were not felt. I measured her pubo tuberos perpendicular, and found it to be 14 cm. Allowing 2 cm. for moderate obesity, the depth of her fore pelvis measured 12 cm., which would make it fall in the male, funnel, or high assimilation (android or anthropoid) class. Her outlet as determined by the T.I. (9.0 cm.) was apparently not contracted. Her pubic rami were obviously long, masking an acute subpubic angle.

Inasmuch as only a few determinations have been made on prenatal patients, it is too early to report the value of this measurement in prognosticating dystocia. In our clinic, this dimension has just been added to the routine pelvic measurements, and after a sufficient number have been taken and correlated with labor records of these patients, a complete report will be made. Before that time, I trust others will begin the routine use of it, so that enough clinical data can be obtained soon to enable us to judge its usefulness.

REFERENCE

- Caldwell, W. E., and Moloy, H. C.: *AM. J. OBST. & GYNEC.* 26: 479, 1933.
2340 EUTAW PLACE

A SURVEY OF ONE THOUSAND GONOCOCCUS COMPLEMENT
FIXATION TESTS PERFORMED WITH THE SERUM
OF FEMALE PATIENTS IN AN OUT-
PATIENT CLINIC*

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Public Health Institute)*

I. INTRODUCTORY

THE object of this study was to analyze the results of routine complement fixation tests performed with the blood serum of female patients in a large clinic treating ambulatory cases, and to establish with the aid of clinical study the practical value of this laboratory procedure. A similar study was made by us previously on one thousand serums of male patients. It was reported upon elsewhere.¹ The present analysis is based upon a study of 1,000 tests performed with the serums of as many female patients. The gonococcus antigen used was the same type of commercial preparation of a suspension of pure cultures of gonococci as was described in the report just referred to. The complement fixation procedure employed differed from the one used in the previous study in one minor and one major technical detail. In the first study two tubes containing antigen were used. The first tube contained 0.5 c.c. and the second 0.25 c.c. of the 1-20 dilution of the patient's serum. The procedure in the present study omitted the tube containing 0.25 c.c. of the serum dilution. The major change in the technic pertains to the complement dose. In the report the complement dose consisted of 1 c.c. of a 1-50 dilution of guinea pig serum, representing 4 units of the complement, as per titration. The complement dose used in the present study consisted of 1 c.c. of a 1-35 dilution of the guinea pig serum, representing six units of the complement, as per titration. The significance of this change is brought out in the discussion.

The preliminary incubation was of the warm type and of one hour's duration. Depending upon the degree of hemolytic inhibition, the results were recorded in accordance with the generally adopted scheme for complement fixation; namely, four-plus, three-plus, two-plus, one-plus, plus-minus, and negative.

The Public Health Institute limits its clinical activities to the diagnosis and treatment of the venereal diseases in ambulatory patients. The

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laboratory facilities are available to physicians, and serums to be tested for the presence of the syphilitic and of the gonococcal antibodies are received. In this respect, the problems confronted by the Institute are somewhat similar to those encountered by public health laboratories in general. The results obtained and the conclusions reached in this study should prove of interest to the public health officials concerned with venereal disease clinics and with public health laboratories.

II. ANALYSIS OF THE RESULTS IN ACCORDANCE WITH THE INTENSITIES OF THE TEST REACTIONS

The cases studied were grouped for purposes of analysis in accordance with the results of the serologic tests as follows:

a. Negative.—Serum specimens from 650 patients, or 65 per cent of the series studied, gave negative results. Five hundred and twenty histories taken at random were examined. It was found that 390, or 75 per cent of the cases reviewed, had conditions which had no apparent bearing upon the gonococcal infection, while 130, or 25 per cent of the 520, had a gonococcal infection in the past or at the time the tests were made. With regard to localization of the inflammatory process, the cases grouped themselves as follows: cervicitis, 11; urethritis, 15; proctitis, 1; bartholinitis, 1; urethritis and cervicitis, 17; urethritis and parametritis, 2; urethritis and proctitis, 1; urethritis and salpingitis, 1; cervicitis and salpingitis, 4; urethritis, cervicitis, and salpingitis, 9; urethritis, cervicitis, and parametritis, 1; urethritis, cervicitis, and proctitis, 9; urethritis, vulvitis, and parametritis, 1; urethritis, cervicitis, proctitis, and parametritis, 1; urethritis, cervicitis, proctitis, and salpingitis, 3; urethritis, cervicitis, bartholinitis and proctitis, 2; and chronic salpingitis, 9. These form a total of 91 cases. The diagnoses of the remaining 39 cases were designated only as "gonococcal infection." They were all cases with a history of a gonococcal infection in the past, and at the time of this study were found clinically negative.

With regard to the period of the existence of the infection prior to the performance of the tests, the following statistical data were obtained: within one week, 32 cases; within two weeks, 5; three weeks, 5; one to two months, 3; two to three months, 3; four to five months, 10; five to six months, 3; six months to one year, 10; one to two years, 13; two to fifteen years, 42; questionable, 4. Among the 61 cases which were tested serologically with negative results within six months from the alleged date of infection were found patients with simple cervicitis, urethritis, etc., as well as cases with more general involvements, such as urethritis, cervicitis, and salpingitis; urethritis, cervicitis, proctitis, and bartholinitis, etc. Of the 9 cases of chronic salpingitis, six originated eighteen months before the examination. Of the remaining three cases two had a postparturition complication on one or more occasions, while the third suffered from complications following an induced abortion.

It is generally considered that the antigenococcal antibody, as demonstrable by the corresponding complement fixation reaction, is at its height between four and six weeks following the infection, when treatment is not applied at once. The antibody begins to disappear rapidly as the affected mucosa yields to treatment. Since in this study the complement dose used consisted of six hemolytic units of complement, and since the cases in this group, easily diagnosed clinically, were subjected to immediate treatment, our inability to demonstrate the presence of the gonococcal antibody by the particular procedure used can be readily explained. Concerning the 9 cases of salpingitis, the same can be stated. The six cases known to be due to a gonococcal infection were old and cured, though pelvic tissue residuals were

found in several. There were three cases of salpingitis which developed following complications other than of the gonococcal origin. They denied ever having had the disease, and no gonococci were demonstrated by the smear method. Therefore, it must be assumed that the conditions in these three cases were of nonspecific origin.

The results obtained from the study of this group do not dispute the specificity of the gonococcal complement fixation reaction; nor do they offer any evidence substantiating the assumption of local as against general body fluid antibody development. Rather, the results indicate that the complement fixation reaction as it is generally carried out in clinical laboratories, is, for the better or for the worse, insufficiently sensitive. Considered from the practical viewpoint, however, it must be concluded that a negative complement fixation reaction in a case with a doubtful history and with suspicious clinical symptoms cannot be taken as an indication of the absence of gonococcal viability.

b. Doubtful (Trace of Hemolytic Inhibition).—Serums of 65 patients, or 6.5 per cent of the entire group studied, yielded complement fixation reactions which are usually designated as doubtful. No information bearing upon the gonococcal infection was found in 47, or 72 per cent of the cases of this subgroup. Evidence of gonococcal infection, past or present, was found in 18, or 28 per cent, of the cases. This constitutes 3 per cent more of cases with evidence of the gonococcal infection as compared with the percentage found among the cases included in the negative group.

With regard to localization of the inflammatory process, the cases were grouped as follows: urethritis, 5; cervicitis, 2; cervicitis and proctitis, 1; urethritis and cervicitis, 4; urethritis, cervicitis, and proctitis, 4; cervicitis, salpingitis, and endometritis, 1; salpingitis, chronic, 1; not mentioned, 2. The last two cases had a history of a gonococcal infection but were clinically negative at the time of the examination.

With regard to the period of the existence of the infection prior to the performance of the test, the following information was obtained: less than one week, 10; of these one had a previous infection seven months ago, and this may have been a flare-up; two months, 1; five months, 1; one to two years ago, 4; three years ago (salpingitis, chronic), 1; questionable, 1.

In judging the significance of a doubtful reaction, its persistence must be taken into consideration. With this in mind, three cases of early infection, and three cases judged to be free from it, were tested each on several occasions, at varying intervals of time elapsing between the tests. Special care was exercised to insure as near as is technically possible a similar level of reaction sensitivity throughout this series of tests. It was found that in the three clinically positive cases the doubtful results persisted, while in the clinically negative cases they were either inconstant or had entirely disappeared.

From the results of this group-study we conclude as follows: Generally speaking, the group of doubtful reactions gave the same results as did those in the negative group, and the comments regarding the first group apply also to this one. However, it should be stated that persistently doubtful reactions in suspicious instances indicate the need of a thorough clinical review of the patients.

c. One-plus.—Serums of 85 patients, or 8.5 per cent of the entire set, gave a one-plus reaction. Clinical records of 60, or 70 per cent of these cases, disclosed no mention of a gonococcal infection, while 25, or 30 per cent of this subgroup, gave a history of an infection or were found diseased upon examination. With regard to the diagnoses in these cases, the following data were obtained: urethritis, 5; cervicitis, 6; proctitis, 1; urethritis and cervicitis, 1; urethritis and salpingitis, 2; urethritis, cervicitis, and proctitis, 1; urethritis, cervicitis, proctitis, and salpingitis, 1; cervicitis and salpingitis, 1; chronic salpingitis, 4; not indicated, 3. With regard to the period of the existence of the infection prior to the performance of the tests, the following statistical data were recorded: one week, 10; four weeks, 1; two weeks, 1; one month, 1; three months, 1; four months, 2; six months, 4; over two years, 5.

Comparing the results of this group with those of the preceding two groups, it was found that the percentage of cases giving a one-plus reaction and which show evidence of a gonococcal infection is thirty, as compared with 25 per cent of the group of negatively reacting, and 28 per cent of the group of doubtfully reacting cases. The presumption of a one-plus reaction as having a bearing on the activity of the infection, therefore, can be regarded as strong. Furthermore, the one-plus reactions of cases tested at the end of one week from the alleged date of infection constitute 40 per cent of those showing evidence of the infection. In the case of the doubtful reactions such cases constituted only 31 per cent. This indicates that in a noteworthy percentage of female patients the gonococcal antibody of considerable potency develops within the first week following the infection.

In judging the significance of a positive reaction, from one-plus up, several facts must be taken into consideration. First, it must be recognized that in the absence of clinical manifestations, the evidence of a previous attack is obviously based upon the statements of the patients. Many female patients give a negative history of a gonococcal infection when they have had an infection. This is due most often to ignorance rather than to an intention to deceive. Thus, a large percentage of cases with positive reactions are statistically placed in the group of nonspecific reactions, whereas were the information complete and true, they would be grouped as specific. Second, in the absence of syphilis, even a one-plus reaction persists only when it is the result of the gonococcal antibody. Third, we found experimentally that many serums of patients with a syphilitic infection gave a persistently positive reaction with the gonococcal antigen in the absence of a gonococcal infection. Therefore, special attention should be given to old cured cases of gonorrhea which have a current seropositive syphilis.

Summarizing, we state: No conclusion can be reached regarding the status of a serum on the basis of one test. Where only one specimen is obtainable, a one-plus reaction should be recorded by the laboratory as a doubtful reaction. If upon repeated tests the reaction disappears, the original reaction should be disregarded. If the one-plus reaction persists

in a patient who has not had syphilis, then it should be regarded as presumptive evidence of a new infection, reinfection, recurrent activity, or of a chronic clinically unrecognizable yet active gonorrheal condition.

d. Two-plus.—Serums of 75 patients, or 7.5 per cent of the total, gave gonococcus complement fixation reactions of a two-plus intensity. A study of the clinical histories of these patients showed that 45 of them, or 60 per cent of this subgroup, contained no information bearing on a gonococcal infection, while 30, or 40 per cent of the subgroup, gave a history of the disease. With regard to the localization of the infection, the records showed the following: urethritis, 3; urethritis and cervicitis, 10; urethritis and vaginitis, 1; urethritis, cervicitis and proctitis, 3; cervicitis, vaginitis, and proctitis, 1; urethritis, cervicitis, and salpingitis, 1; proctitis and salpingitis, 1; proctitis and endometritis, 1; urethritis, cervicitis, and arthritis (right wrist), 1; urethritis, cervicitis, proctitis, and Bartholinitis, 1; urethritis, cervicitis, and Bartholinitis, 1; urethritis, proctitis, Bartholinitis, and salpingitis, 1. Information regarding the existence of the infection prior to the performance of the tests was recorded as follows: one week, 17; three months, 2; four months, 1; five months, 2; seven months, 1; eight months, 1; over three years, 2; questionable, 1.

The percentage of cases giving a 2-plus reaction which showed evidence of a gonococcal infection was 56, as compared with 40 per cent of the one-plus group. This shows that with an increase in the intensity of the reaction, the presumptive evidence of an active gonococcal infection is raised. Furthermore, the two-plus reactions of cases tested within the first week from the given date of infection, constitute 57 per cent of those showing clinical evidence of the infection. In the group showing a one-plus reaction the percentage of such cases was 40, and in the doubtful group only 31. This we take as an indication that a number of individuals having a gonococcal infection respond to it by a production of specific antibody demonstrable in the circulatory fluid within the first week.

In judging the significance of the two-plus reaction the same factors must be taken into consideration which were discussed under the preceding group, namely: definiteness of the information regarding a previous infection; duration and type of treatment, if any prior to the time the test was made; persistence of the reaction (at least three tests should be made); and the presence of a current seropositive syphilis. In view of the results obtained from this study we feel safe to suggest that a two-plus gonococcus complement fixation reaction, interpreted in the light of the preceding discussion, is of practical assistance in determining early or chronic, yet active, cases of suspected gonococcal infection in the female.

e. Three- and four-plus.—Serums from 128 patients, or 12.8 per cent of the entire series, gave three- and four-plus gonococcal complement fixation reactions. It was found that 50, or 40 per cent of the group, had no information in their clinical records bearing upon a gonococcal infection, while 78, or 60 per cent, had an infection prior to or at the time of the performance of the tests. The information obtained concerning the localization of the inflammatory processes and the period of time elapsing between the alleged dates of the onset of the infection and the time of the performance of the tests was similar to the information obtained in connection with the study of the two-plus reaction group.

The question, how to account for the occurrence of the 40 per cent presumably nonspecific reactions, arises in this group more objectively than in connection with any of the previous positive groups. The following analytical table answers this question partly. In this table are listed the results of repeat tests performed with eight serums, four of which came from patients who had syphilis and presumably no gonorrhea, and four having syphilis and gonorrhea of varying duration.

TABLE I

CASE	DIAGNOSIS OF SYPHILIS	GONOCOCCAL INFECTION	NO. OF POSITIVE G. C. FIXATION TESTS (3-PLUS AND 4-PLUS)
1	Positive	Negative	2
2	Positive	Negative	3
3	Positive	Negative	2
4	Positive	Negative	2
5	Positive	Urethritis Cervicitis Proctitis	3
6	Positive	Urethritis Cervicitis 6 mo. duration	2
7	Positive	Salpingitis Double Chronic	2
8	Positive	Urethritis Cervicitis Salpingitis 2 wk. duration	3

The results listed in this table indicate that in the presence of a persistent positive serum reaction with the beef-heart antigen no value should be attached to an equally persistent 3- or 4-plus reaction with the gonococcal antigen. A number of cases free from a gonococcal infection and old cured cases of gonorrhea yield the same results and with the same persistence as do new and active chronic cases. In the group under present discussion were found 28 serums, or 22 per cent of the subgroup, which persistently reacted to the beef-heart antigen, and which presumably did not have a gonococcal infection. With a complete knowledge of the serologic status of the patients, this 22 per cent can be definitely accounted for by the clinician. There remain accordingly 18 per cent of cases which must still be accounted for. We believe that fully one-half of these would be accounted for as active, though listed as chronic cases, if the historical information had been correct and noted in the clinical record with greater care. Nine to 10 per cent of the cases, however, must be regarded as nonspecific.

III. ANALYSIS ACCORDING TO INFLAMMATORY LOCALIZATION AND PERIOD OF INFECTION PRECEDING THE GONOCOCCAL COMPLEMENT FIXATION TEST

The information concerning these two important factors is summarized in an analytical manner and in terms of percentages in Tables II and III.

The information offered by Table II shows that the type of gonorrheal involvement in female patients has no bearing upon the intensity of the complement fixation. We infer from this that the production of the gonococcal antibody by the female organism infected

with the organism in no way parallels the inflammatory character of the disease. The information offered by Table III, on the other hand, shows that the reaction of the female organism to the gonococcal in-

TABLE II

INTENSITY OF THE REACTION	CERVIC- ITIS	URE- THRITIS	URE- THRITIS AND CERVIC- ITIS	COMPLICA- TIONS	SALPINGITIS
	PER CENT	PER CENT	PER CENT	PER CENT	PER CENT
Negative	46	45	43	35	46
Doubtful	8	12	10	8	4
One-plus	22	16	2	7	14
Two-plus	None	9	30	15	6
3- and 4-plus	24	18	15	35	30

TABLE III

INFECTION PRECEDED TEST BY	NEGATIVE PER CENT	DOUBTFUL PER CENT	ONE-PLUS PER CENT	TWO-PLUS PER CENT	3- AND 4-PLUS PER CENT
One week	23	31	40	56	60
Four weeks	3	None	12	None	5
Up to 6 months	8	35	32	17	15
Up to 1 year	5	6	8	13	7
Over 1 year	27	15	8	10	7
Questionable	34	13	8	4	6

vasion differs with individual patients, but that the factor of time is closely associated with the intensity of the reaction, or amount of specific antibody present in the circulatory fluid.

A preliminary study by the antibody titration method also indicated to us that with a low titer of complement, positive reactions can be obtained in from 85 to 95 per cent of the infected patients within from one to two weeks from the time of original infection. As the treatment progresses the titer becomes rapidly reduced, and finally becomes negative, and equals the titer of the control. Chronic cases, free from syphilis, reacting positively with the gonococcal antigen, show a variable but persistent titer.

IV. DISCUSSION

A discussion of the theoretical aspects of gonococcus complement fixation based upon the results of our present study should prove fruitful from the viewpoint of its helpfulness in properly understanding the reaction. We are, however, concerned at the present primarily with the practical significance of the results. In evaluating the results we are led to conclude that in routine clinical work gonococcus complement fixation results should be considered specific only after certain factors have been taken into consideration. In the early stages of a suspected new infection, the persistence of a positive reaction, regardless of its

intensity, is of importance, and points to the specificity of the reaction. The fact that a large percentage of the cases, known to have gonococcal activity, give negative results, is due entirely to the use of a strongly lytic complement unit, which renders negative otherwise weakly positive results.

The method by which gonococcal antigen is at present prepared generally, makes the use of a high complement unit imperative. But steps are now being taken in the direction of the purification of the antigen, which will enable the laboratory worker to reduce the lytic potency of the complement unit and thereby render the reaction more sensitive, without affecting its specificity. Thus, McNeil² uses a purified suspension of artificially grown gonococci, while Retzlaff³ uses Pieper and Wolffstein's "compligon." She claims that the reaction appears within five days of the infection, and that a weak reaction with "compligon" is an indication of the catarrhal condition of the mucosa, even before the microorganisms can be demonstrated. She further concludes that a persistent positive reaction is an indication of continued activity of the disease, even though gonococci cannot be demonstrated. However, similar to the results obtained by us, she found that positive syphilis serum of patients free from the gonococcal infection gives positive results with the "compligon" antigen.

The main drawback to the more extensive use of the gonococcus complement fixation reaction in the detection of this disease is presented by the cost of and the difficulty with which the antigens are prepared. Commercial preparations, in addition to their high cost, are apparently prepared with insufficient attention to the needs of the laboratory worker. On the basis of our two studies and of an extensive review of the literature, we feel, nevertheless, that the complement fixation reaction, judiciously interpreted by the clinician, will enable him to establish definitely a large number of active infections a week to ten days before he can establish it clinically.

The question of chronic, presumably cured cases, is of paramount importance. Here are encountered such confusing factors as the behavior of the individual patient, inability on the part of the clinician to establish through a history or examination evidence of a previous attack of the disease, and the carelessness of some clinicians in dismissing patients from treatment before adequate tests of cure are made. When the treatment administered has been of the proper type; the patient has been carefully observed; the catarrhal condition of the mucosa has cleared; and repeated slide examinations have proved negative; then a complete picture of a cured case is presented. The positive reaction obtained with the serum of such a patient is, therefore, regarded lightly by the clinician.

One important factor in such cases as are described above has been overlooked: namely, the effect upon the tissue of a low grade but con-

tinued activity of a few gonococci. Depending upon the balance that may be established between the residual host and the process of local tissue immunity, no symptoms of activity may appear for a long time. In most cases the residual host is finally eliminated. But in a percentage of the cases vague symptoms of activity will reappear. Hence, the reporting of positive complement fixation reactions in so-called cured cases.

Such conditions were encountered by us in our study. Nor are we alone in this experience. Neisser,⁴ for instance, found in chronic gonorrhea in women that often a slight secretion which can be expressed from the glands of Bartholin, which are healthy in appearance, were rich in a gonococcus content. In a series of 143 cases the same author⁵ found that in cases of old urethritis free from clinical symptoms and from objectively demonstrable changes in the urethra a painstaking search resulted in the disclosure of harbors of gonococci. Gill⁶ believes that in the gonococcus infection a latent period exists, which many physicians do not recognize but regard such cases as cured. He recommends the extensive use of the urethroscope, with which he claims to have found evidence of gonococcal activity in cases as old as ten years. There may be some merit in his recommendation, for Retzlaff³ has found that with her procedure of complement fixation, negative results are obtained in many cases of gonorrhea in which the mucous membrane is apparently clear.

In our opinion positive complement fixation results are rarely obtained in the instance of old cured patients, for the gonococcal antibody persists from one to six weeks only following the disappearance of the organisms.

The experience of Edith Retzlaff³ parallels ours in that she found that from three to four weeks after the cure is established the reaction completely disappears. Inoue and Nagasaki⁷ found that following a single intravenous injection of a clear extract of a polyvalent gonococcal suspension, a high titer of gonococcal complement fixation develops, but that the titer completely disappears within one month. Following two injections the titer remains somewhat longer.

We feel justified, therefore, in restating our opinion: In the absence of a seropositive syphilis, a persistently positive gonococcus complement fixation test establishes active gonorrhea. If a new infection is definitely excluded, the existence of a chronic activity is diagnosed.

Complicated cases of gonococcal infection in the female, according to the results of our study, do not react any more strongly than do simple infections, except so far as they are, as a rule, of longer standing. The time factor, as was shown in Table III, influences the reaction. In cases of salpingitis, especially of the chronic type, complement fixation offers possibly a means for the differentiation of gonococcal from non-gonococcal salpingitis. Similar results were obtained by Blix.⁸ This author investigated 53 cases of salpingitis, in which one or both tubes were involved. Thirty-one gave positive gonococcal complement fixation and 22 gave negative results. Five of the 22 proved tuberculous, 4 had complicated deliveries, and 10 had febrile abortions.

Discussing the diagnostic procedure from a technical viewpoint, we repeat that the greatest obstacle to the more general use of the reaction

in the diagnosis of gonorrhea is the unsatisfactory antigen. The gonococci are grown upon artificial media, and undoubtedly undergo certain physiologic changes which must perforce affect their immunologic properties. In collecting the culture of the gonococci for the preparation of the antigenic suspension, some soluble constituents and solid particles are transferred into the suspension. These strongly enhance the anticomplementary properties of the antigen. Hence, nonspecific reactions are bound to appear. Washing the cultures before making the suspension is of some help. But it must be borne in mind that the removal during the washing of some of the adventitious materials also removes the adsorbed polysaccharides, which, as was shown by Zozaya,⁹ take part in the formation of the specific antigen-antibody complex. The same is true of the water-soluble extracts used as antigen in this complement fixation reaction and of the lipoid antigen used in the Meinicke¹⁰ precipitation reaction for the diagnosis of gonorrhea. Retzlaff³ using the "compligon" and Marquardt¹¹ the Meinicke flocculation reaction encountered nonspecific results in cases free from seropositive syphilis.

To lessen the frequency of the occurrence of nonspecific results, and possibly to eliminate them, a complement dose of high "lytic" potency should be used, as was suggested by Kolmer.¹² True, with such a procedure of gonococcal complement fixation many of the early and weak reactions are rendered negative, but the procedure as a whole is thereby placed upon a safe level of reactivity.

SUMMARY

A study of the complement fixation results obtained with 1,000 serums of as many female patients in an out-patient clinic was made and the results were analyzed in the light of the clinical information contained in the patients' clinical charts. Some of the recent literature on this subject was reviewed, and the results coordinated with the results of the study presented.

REFERENCES

- (1) Brunet, Walter, M., and Levine, B. S.: *Am. J. Clin. Path.* 3: 429, 1933.
- (2) McNeil, Archibald: *Proc. Soc. Exper. Biol. Med.* 29: 983, 1932. (3) Retzlaff, Edith: *Klin. Wehnschr.* 11: 2078, 1932. (4) Neisser, A.: *Med. Life* 39: 543, 1932. (5) Neisser, A.: *Med. Life* 39: 548, 1932. (6) Gill, Frederick: *Irish J. M. Sc.*, p. 665, 1932. (7) Inoue, M., and Nagasaki, T.: *J. Kumamoto Med. Soc.* 8: 89, 1932. (8) Blix, A. Schytte: *Acta Med. Scandinav.* 50: 332, 1932. (9) Zozaya, José: *J. Exper. Med.* 55: 325, 1932. (10) Meinicke, E.: *Klin. Wehnschr.* 10: 1757, 1931. (11) Marquardt, F.: *Dermat. Wehnschr.* 95: 1787, 1932. (12) Kolmer, John A.: *Serum Diagnosis by Complement-Fixation*, Philadelphia, 1928, Lea and Febiger.

THE TREATMENT OF *TRICHOMONAS VAGINALIS* VAGINITIS WITH SODIUM PERBORATE AND QUININE

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OF ALL the varieties of leucorrhea, that caused by the *Trichomonas vaginalis* is one of the most resistant to treatment and difficult to cure. A distinction must be made between relief and cure, for many of these cases have been symptom-free without treatment from three months to one year, and have then had recurrence of the vaginal discharge, itching of the vulva, and discomfort in the external genitals.

After a trial of the popular methods of treatment, I am presuming to add still another, which has proved extremely efficient, not only in my own cases but also in those of my associates at the New York Post-Graduate Hospital. A series of forty-seven cases have been observed and treated. A patient was not considered cured until she had reported repeatedly for examination after six, nine, or twelve menstrual periods, without evidence of leucorrhea, itching, or other annoyances suggestive of a recurrence of the trichomonas involvement, and negative hanging-drop microscopic examinations. Nine patients were single girls and virgins; ten were single and not virgins; five were children under fourteen; six were married women; seven were married and pregnant; ten were married and had been delivered of children. No individual in this series showed evidence of an existing or previous gonococcal infection on her first visit. Every patient had been suffering from this condition for from a minimum of six months to a maximum of four years, and each one was able to describe the various types of treatment she had received, either at a hospital or at the hands of a private physician, and what treatment she had carried out at home. The method to be described delegates nothing to the patient.

My only excuse for reporting such a small series of cases is the uniformity of the prompt relief experienced by the patients, and the apparent permanency of end-results. The technic I have found most satisfactory is as follows: After a careful history, the patient is examined; a hanging-drop specimen is taken from the vagina in the usual manner and trichomonads identified; cultures are made and a smear stained for gonococci. Having established the diagnosis of *Trichomonas vaginalis* vaginitis, treatment is begun. Two quarts of a solution of two tablespoonfuls of sodium perborate at temperature of 100° F. is used to irrigate and distend the vagina, by means of a special occluding vaginal syringe (Fig. 1). The fluid is allowed to run into the vagina through an upper channel in the apparatus, while

a tube running from the lower channel carries off the return flow into a bucket. A rubber shoulder on the syringe fits snugly against the vaginal introitus, making it air and water tight and preventing regurgitation of fluid from the vagina and around the apparatus. The lower tube is pinched off for about one-half a minute, thus permitting distention of the vagina and eradicating all crevices, wrinkles, and pockets in the anterior, posterior, and lateral fornices where the trichomonads usually lodge. The pressure on the lower tube is then relaxed and the vagina permitted to empty itself. The maneuvers are repeated until the reservoir is empty. When the fornices are fully distended, the patient usually complains of a fullness or aching in each groin, which denotes maximum stretching of the vault of the vagina and is an additional signal to release the pressure on the lower tube. This distention and irrigation rids the vagina of all inflammatory debris and mucus and cleanses every crevice in the vaginal mucosa and fornices. After the irrigation has been completed, the vagina is wiped dry, a suitable vaginal speculum inserted, and quinine sulphate powder is blown into the anterior, posterior, and later fornices down to the vaginal introitus, using a Powdex powder blower. The labia are separated and more powder is blown over the vestibule and external genitals. The patient is instructed to report daily thereafter for one week, and every alternate day for the next week. No vaginal douches or suppositories are prescribed. Treatment is not interrupted by a



Fig. 1.

menstrual period, although no irrigations are given during the flow; the vagina is merely wiped dry, freed of clots, and insufflated with the powder.

Sodium perborate was selected as the irrigating agent because it is alkaline and quickly overcomes the hyperacidity produced by the trichomonads. It readily gives off nascent oxygen and is bactericidal to the vaginal flora. The effect of the nascent oxygen is bubbling in character, similar to that of peroxide, and tends to dislodge mucus and debris from the deep recesses of the vagina. Quinine sulphate in experimental tests has proved to be highly destructive to the *Trichomonas vaginalis*. Its continuous presence in the vagina destroys the trichomonads in a very short time and inhibits the growth of spores.

Patients presenting themselves soon after the initial attack responded promptly to the treatment and were found invariably to be free from the trichomonads after the next menstrual period, and remained so thereafter. All the other women who had been suffering from the infection for from one to three years previously were cured within from two to four months, and have been observed for a year or more without treatment.

There were no toxic effects observed from the use of quinine in any of these patients except in two cases. One patient showed evidences of quinine idiosyncrasy and here the quinine sulphate was mixed with equal parts of starch or zinc oxide powder. In the other case, the patient complained of a menorrhagia most likely due to some absorption of quinine from the vagina and its emmenagogue effect upon the uterus. In this case the quinine was similarly treated. The amount of quinine blown into the vagina at each sitting is equivalent to about $7\frac{1}{2}$ grains and in very

bad cases, no more than 15 grains. This is enough to coat all the vaginal walls and the external genitals.

A few typical cases are of interest. Miss S. A., twenty-three years old, consulted me on Dec. 24, 1932, suffering from *Trichomonas vaginalis* for three years, had been treated unsuccessfully by several physicians with the usual remedial agents. Hanging-drop specimen showed five or six trichomonads to the high-powered field. After treatment by the method already outlined, trichomonads could not be found after her menstruation starting February 11, nor after periods on March 18 or April 22. She was reexamined July 22, having had no treatment for two months, and is still free from trichomonas and symptoms.

Mrs. R. R., twenty-four years old, married, was referred to me by Dr. S., her chief complaint being vaginal discharge for four years. The physician who first saw her treated her with applications of silver nitrate to the vagina. These treatments were given three times a week for six months. The patient, seeing no improvement, consulted a gynecologist who treated her with mercurochrome daily for two months and every other day for two more months. As her condition was still unimproved, she consulted another physician who treated her with tincture of green soap and bichloride for nine months. At the expiration of this time, her condition was practically the same as in the beginning. She was familiar with all the treatments she had received and the condition from which she was suffering. On her first visit to my office she had intense redness of the external genitals extending down to the middle of the thigh on the inner surface. This was accompanied by itching and burning of these parts. There was a profuse yellowish frothing discharge from the vagina and a hanging-drop showed from seven to ten trichomonads to the high-powered field. She was placed on the routine treatment as described and was greatly improved after the first month, was completely free from the symptoms after the second month, and was discharged cured after six months, trichomonas-free and free from symptoms. She has reported monthly without treatments for the past six months after her menstrual period and is still free from trichomonas and symptoms.

Miss S. G., thirty-one years old, single, one and one-half years ago developed a severe itching of the external genitals and profuse yellowish vaginal discharge. This patient was a school-teacher and her discharge was so profuse that it would necessitate her leaving the classroom frequently to prevent the discharge from running down her thigh and leg. At times she was desperate due to the annoyance caused by this condition. She was treated for four months by her family physician with daily douches and at the end of that time he referred her to a "specialist," as she stated, who treated her for six months with Lassar's paste. She was finally referred to me by Dr. S., with the clinical diagnosis of trichomonas infection. She was placed on the perborate and quinine treatment and became negative after her fourth period, having had no treatment that month. Smears have been negative ever since for six months without treatment.

Mrs. I. H. S., aged thirty-eight years, complained of a yellowish vaginal discharge for one year. She consulted several doctors who took smears of the vaginal discharge. Some reported that it was positive, others that it was negative, for gonorrhea. When informed of these findings, she consulted her brother, a prominent urologist of this city, who immediately communicated with doctors who had taken the smears. The doctors who claimed that the smear was positive stated that it was positive for pus cells but not for gonococci. The physician who found the smear negative also said that it was negative for gonococci, but pus cells were present. She was treated by these men for several months on the basis of a gonococcus infection without any improvement. A few months after the beginning of this condi-

tion her daughter, a child of nine years, developed the same symptoms and was treated for gonococcus infection by the instillation into the vagina of argyrol through the small-sized catheter. On my first examination of both mother and daughter, a hanging-drop and smear investigation was made. The child's specimen showed from three to six trichomonads to the high-powered field. The mother's showed from seven to ten trichomonads to the high-powered field.

Mother and daughter were placed upon the treatment referred to and discharged seven months ago, trichomonas-free after three consecutive periods for the mother, and after three monthly examinations for the child. The mother and daughter were examined three months after their last examination and are both free from trichomonas symptoms. Needless to say, the suction syringe was not used on the child but irrigation with sodium perborate through a No. 20 French catheter filling the vagina and occluding the outlet and then permitting the fluid to run out.

This erroneous diagnosis of gonorrheal infection in the mother estranged the husband immediately thereafter and almost led to a divorce suit.

I wish, therefore, to stress the importance of a combined smear and hanging-drop examination in all cases of indefinite vaginal discharge.

241 CENTRAL PARK WEST

THE TREATMENT OF DISEASES OF THE CERVIX BY THE ELECTROSURGICAL UNIT*

WITH SPECIAL REFERENCE TO CERVICITIS

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CERVICAL infection, which is perhaps the most frequent of all the pelvic diseases, has, modern gynecologists believe, enormous potentialities for harm, trivial though its manifestations may seem. A disease which can initiate infections of the upper pelvis, which can cause spontaneous postoperative and postpartum infections, which can serve as a focus of systemic infection, and which, however much pathologists may deery the term, has been proved to be a precancerous condition, is obviously a disease of serious consequences and deserving of serious consideration. It is not surprising, therefore, that a host of procedures have been advocated for its correction, though the literature that has grown up about them proves with equal clarity that none of them is entirely adequate, that all of them are open to more or less serious objection. Cervicitis associated with lacerations extensive enough to demand, per se, hospitalization and radical surgical measures furnishes, in one sense, no particular problem, but the situation is quite different with the great majority of cases in which the infection rather than the laceration demands the chief consideration or in which only the infec-

tion is present. Such patients, as a rule, resent hospitalization and its consequent expense, as well as the more or less prolonged convalescence which follows any but the simplest procedures, while the methods advocated for office use are frequently either inadequate or decidedly more complex than they are described as being. Many of the methods, too, simple as well as radical, have the further grave defect that they either vitiate or seriously impair future function.

The ideal, therefore, would seem to be some method which would be applicable in both the clinic and the office and which would, while effecting a cure, restore the normal anatomy of the parts and preserve normal function. But these criteria, simple as they seem at first glance, are in reality not so easily fulfilled. Cervicitis is an infectious disease which is rooted in a soil peculiarly capable of guaranteeing its persistence and encouraging its spread. The anatomy of the parts ensures that. The short, spindle-shaped cervical canal is lined with a mucous membrane composed of complicated racemose glands and thrown into multiple corrugated folds, in the crypts and pockets of which, once infection has entered, spontaneous cure is not to be looked for and tenacity of existence is assured. Furthermore, quite aside from extension by continuity of structure, upward extension can easily occur by way of the continuous lymph system which supplies all the pelvic organs. When obstetric injuries are present, the tendency to persistence and extension is many times increased, for the raw surfaces furnish a fertile soil for bacterial growth and the resulting scar tissue, by interfering with lymphatic drainage, keeps up a constant unhealthy congestion in which bacteria thrive.

These are facts that would seem, perhaps, too elemental to be repeated were it not so evident that they are many times completely ignored in the therapy of this disease. Local measures, for instance, are still being advised for the treatment of cervicitis, with a blissful disregard of the obvious facts that the superficial application of antiseptic agents can have no possible effect on bacteria which have made their way into the deeper structures almost as soon as they have made their entrance, and that agents strong enough to destroy them will inevitably damage first the more delicate body tissues. Cauterization, hailed in many quarters as a panacea for cervical disease, undoubtedly has its advantages, but the other side of the question must not be forgotten. It is not applicable when lacerations are at all extensive. It is ineffective when the infection has passed beyond the mucosal layer of the cervical canal and into the muscularis. It may give rise, even in expert hands, to extensive cicatrization and stenosis. Finally, since in the normal course of events a burn is always followed by a slough, necrosis is part of the healing process, and the casting off of the

necrotic tissue is frequently attended by hemorrhage which is sometimes very serious.

Both local applications and cauterization are possible office procedures, but all of the surgical measures demand hospitalization. Leaving out of the discussion the highly undesirable operation of amputation, and the Schröder operation, which is applicable only in those cases in which the laceration is quite extensive, both trachelorrhaphy and the Sturmdorf operation, which are admirable from many standpoints, must be done, except in the occasional case, under general anesthesia, both of them require hospitalization for at least a week and preferably more, and both of them, as Wolfe points out, are unsatisfactory either anatomically or functionally in one out of every five cases.

The principle of the Sturmdorf operation, however, fulfills all the requirements for a cure. It is devised to remove that portion of the cervix in which, in the average case of cervicitis, the infection is located. It is really a cone-shaped excision of the gland-bearing area of the canal, and in any case in which the infection has not spread beyond the mucosal coat to the muscularis—it must be remembered that the cervix has no submucosa—it is entirely adequate. It would seem, therefore, that any method by which this same result could be achieved without the economic inconvenience involved in a hospital stay and without the administration of an anesthetic and the discomfort of a surgical convalescence would be a very desirable method.

All of these advantages are, it seems to us, achieved by the use of the electrosurgical unit as advocated by Hyams in 1928 and later by Roblee in 1931. The diseased area of the cervical canal is eliminated, just as in the Sturmdorf operation, without impairment of the integrity of adjacent tissues. Cervical stenosis and other anatomic distortions do not follow its use, and there is no interference, therefore, with future function. The procedure can be employed with perfect safety in the office or the clinic and can be used also, in combination with other procedures of a surgical nature, in the operating room. Finally, the immediate effects are so slight that the patient is ambulatory at once and can resume her usual occupations with practically no delay.

The apparatus is supplied in two types, the radio-tube, with which we have had no personal experience, and the spark-gap. In both types there is a cutting (undamped) current and a coagulating and desiccating (damped) current. Electrodes are of various shapes and sizes. Our technic, which is almost precisely the technic originally described by Hyams, needs no detailed discussion, though it should be stated that in cases of eversion complicating chronic infection we have used the triangular rather than the spindle-shaped electrode which he advises, in order to eliminate the recutting necessary if his method is followed exactly. It should be emphasized, too, that the contact of the electrode with any metal instrument, such as a speculum or tenaculum, will

damage it or break it, and if unceasing care is not exercised in this particular the resulting expense is likely to be considerable.

Since August, 1932, we have employed this method in 202 cases of cervical infection, including:

107 cases of chronic cervicitis and endocervicitis.

50 cases of cystic cervicitis.

45 cases of cervicitis complicated by simple, follicular or papillary erosion.

All of these patients were treated in the clinic, under local analgesia. The cervix was coned out with the conization electrode (cutting current) and all of the diseased, gland-bearing area of the canal was removed, just as in the Sturmdorf operation. Cysts were punctured with the straight electrode.

In all but three of these cases the procedure was smooth and without incident. In one case the patient, despite the routine warning to inform us immediately if we were causing her pain or discomfort—under such circumstances the procedure is discontinued immediately until the analgesia is satisfactory—moved so suddenly and violently that she bent the indifferent electrode. As a result she sustained a linear second degree burn over the left posterior lumbar region; it caused her considerable inconvenience but did not, of course, alter the local result. Another patient, in whom the conization was associated with an excision of the right Bartholin gland, bled moderately at the time of the operation and had to be packed. Next day rather profuse hemorrhage occurred, and transfusion had to be resorted to before it could be checked. Further investigation revealed a history of similar profuse bleeding following the extraction of a tooth some years before, and blood studies showed that a constitutional state rather than an error in technic was responsible for this complication.

In the third instance the patient aborted on the twelfth day. It seems scarcely necessary to say that the method was employed without knowledge of her state, for her history, checked by careful questioning after the accident, gave no hint of the gestation. Hyams' report mentions several cases in which the electrosurgical unit was used in the treatment of cervicitis during gestation, but he personally does not advocate this method, nor do we, for it is easy to conceive that the risks may be far greater than the possible benefits.

Ten cases of cervicitis associated with lacerations deep enough to need independent treatment were submitted to trachelorrhaphy in the hospital. The loop electrode with the cutting current was utilized as a scalpel, after which the cervical lips were sutured as in the usual plastic operation. These operations were all done without any complication.

The amount of conization to be done can be determined only by the experience gained by a careful study of all the patients at definite and regular intervals (we prefer five, ten, and twenty weeks) after the operation. The amount of tissue to be removed depends, naturally, not only upon the extent of the disease but also upon the age and social state of the patient. The majority of these women were still in the child-bearing years, most of them between twenty and thirty-five years, with extreme limits of seventeen and forty-six years. In the young women we were as conservative as possible. In women approaching the menopause, in whom marked cervical hypertrophy and cystic formation suggested a long-standing and deep infection, we used the large, triangular electrode and removed not only the endocervix but some part of the musculature also. If eversion is more marked on the anterior lip, excessive excision or overcutting seems to be safe; on the posterior lip, where, fortunately, the eversion is rarely as extensive, this method is less desirable.

Overcoagulation to check oozing seems simple and safe, but actually, as we learned from an unfortunate early experience, it is not. We used this plan deliberately in one case in which there was an excessive and annoying ooze and believed, since there was no gross destruction of tissue evident, that we had done no harm. Subsequent examination, however, showed an almost complete absence of the posterior cervical lip and a knuckling into the canal of the anterior lip, whose size had been much reduced. The patient seems to have suffered no ill effects from the accident, but we now check oozing by the insertion of a small iodoform pack.

In the colored patients, who furnished some 40 per cent of the series, healing was complete within five weeks in all cases, but in the white patients the process occupied six weeks. Why there should be this difference we cannot say. Colored patients of the class handled in Charity Hospital are notoriously unhygienic, and it would seem that any delay in the healing process would occur in them rather than in the white patients.

The anatomic results in all the cases of chronic cervicitis, with or without complications, were most gratifying. Examination at routine intervals after the operation almost invariably showed a complete absence of the pathologic changes caused by the infection, while in some cases it was hard to believe that one was not inspecting a virgin cervix. In no case was there any evidence of stenosis.

Leucorrhea, that invariable accompaniment of infection, was relieved in fully 95 per cent of the cases. Those patients in whom it still persisted exhibited only pelvic disturbances, such as retrodisplacements, small fibromyomas and chronic pelvic disease. In the light of our ex-

perience we shall no longer use this method in the latter group of cases. Fulguration is more satisfactory, we now believe, if radical surgical measures are not indicated or are refused.

Backache and lower abdominal discomfort were relieved in all cases in which they had been part of the picture, but dysmenorrhea was still present except in the occasional case. That, of course, is what is to be expected; essential dysmenorrhea is not likely to be corrected by the correction of an associated condition which plays no part in its production. Sterility also was not relieved. We have had, for that matter, only one pregnancy following conization, and that is still in its early stages, but we see no reason to question Hyams' statement that gestation and parturition are unaffected.

In addition to the 212 cases of cervicitis just discussed, we have used this method in other, smaller groups of cases. Five fibromas of the cervix were removed with the electrosurgical unit, without complications and with satisfactory end-results. In 15 cases in which supravaginal hysterectomy was done but in which, for one reason or another, the complete operation seemed unwise, a prophylactic amputation of the cervix was done by this method. Convalescence was without incident, and the procedure impresses us as an admirable one, particularly for the surgeon whose experience with the complete operation is limited and who frankly subjects his patient to a greater risk when he performs it. Nothing is gained, in our opinion, by not admitting that this is very frequently the situation.

Biopsy was done with the electrosurgical unit in 6 patients in whom malignant disease was suspected, and such specimens are entirely satisfactory if the proper technic is employed. If, however, a machine is used which has a damping effect in the cutting current, the microscopic sections are very brittle when cut and stained, and recutting is frequently necessary. This difficulty is entirely a matter of mechanical adjustment, and our later cases did not exhibit it.

Finally, in 12 cases of carcinoma of the cervix we used this method as a preliminary to irradiation, to remove fungating, proliferating malignant masses which were an obvious source of toxemia and whose bulk obviously limited the action of the radiant rays. The advantages of such an excision in carcinoma of the cervix, just as in carcinoma of the breast, are universally granted, even in hopeless cases. In one instance the result was particularly good. Instead of the enormous mass which had been present when the patient was first seen, subsequent examination two months later showed it entirely gone, and the vaginal epithelium to be smoothly healed over the cervical remnant. In this case, in addition to the removal of the vaginal mass, we passed the coagulating electrode into the body of the uterus, applying it for forty seconds at each of four

points. We do not recommend this procedure, however, until one is fully cognizant of the depth of coagulation of the particular machine and the particular electrode one is using. Calibration, of course, will impart this information.

SUMMARY

1. The electrosurgical unit, according to the technic of Hyams, has been used by us in 212 cases of cervicitis of various types, with anatomic restoration of the parts and relief of symptoms, as well as with preservation of function, in approximately 95 per cent.

2. This method has also been employed for other conditions, in smaller groups of cases, including fibromas of the cervix and cervical carcinoma, in the latter condition as a preliminary to irradiation. It was used for biopsy in 6 cases.

3. The majority of these cases were handled in the clinic and the patients were ambulatory. The method, therefore, is preferable to the Sturmdorf operation, the principle of which it duplicates, which requires hospitalization and a more or less prolonged surgical convalescence.

4. Justification for this report lies in the fact that other procedures advised for the relief of cervicitis give a fairly high percentage of unsatisfactory results, chiefly because many of them do not take into account the anatomic and pathologic changes they have been devised to correct.

REFERENCES

- Harriman, W. F.: *AM. J. OBST. & GYNEC.* 18: 250, 1929. Hyams, M. N.: *N. Y. State J. Med.* 28: 646, 1928. Hyams, M. N.: *Arch. Phys. Therap.* 11: 171, 1930. Hyams, M. N.: *Med. Times* 58: 268, 1930. Hyams, M. N.: *AM. J. OBST. & GYNEC.* 25: 653, 1933. Kimble, H. E.: *Arch. Phys. Therap.* 14: 83, 1933. Roblee, M. A.: *AM. J. OBST. & GYNEC.* 22: 64, 1931. Wolfe, S. A.: *AM. J. OBST. & GYNEC.* 24: 87, 1932.

Ruble, W. K.: *Trichomonas Vaginalis*, *Northwest Med.* 33: 14, 1934.

Ruble found that in a suspension of 1 to 500 copper sulphate solution, all ciliary action and all other evidences of life in the trichomonas ceased in from two to five minutes. The treatment which Ruble recommends consists in the use of suppositories containing magnesium salt. In a series of 43 cases, 14 were not seen after their symptoms were relieved, 12 were not cured and in 11 of these the infection was not limited to the vagina. However, 17 or 39.5 per cent were definitely cured. Nine of the 43 patients were operated upon by the author. Five of these were seen during attacks of mild pelvic inflammatory disease while they were undergoing treatment for trichomonas. At the time of operation each patient had that type of inflammatory reaction of the pelvis which one would expect to find following a gonorrheal salpingitis. The author, therefore, gives some recognition to the trichomonas as an etiologic factor in salpingitis and pelvic inflammation.

J. P. GREENHILL.

CANCER AND PROLAPSE OF THE UTERUS*

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WITH rare unanimity it is stated in those textbooks in which any mention is made of the subject, that carcinoma hardly ever develops upon a prolapsed uterus. Theoretically, this is rather surprising; for, if the theory of chronic irritation has any validity whatever, all the necessary premises for the development of carcinoma are given; namely:

1. The prolapsed uterus is continually exposed to irritation and trauma.
2. The condition occurs most often in elderly women, who have borne children.
3. Lacerations and erosions of the cervix are common.
4. Decubitus ulcers, although they may develop on any part of the exposed mucosa, are usually near the external os and always secondarily infected.

Yet, contrary to all expectations, we have been able to find only a small number of cases in the literature where prolapse was combined with cancer.

Pontow, in 1893, collected only 29 instances to which he added an observation of his own. Four additional cases were reported by Schmidt, Kurtz and Macleod. In 1931, Delvaux wrote that of the 19 cases of prolapse he had observed in the past twenty years, not a single one was complicated by cancer. In answer to a questionnaire sent by him to numerous prominent European gynecologists, Schroeder of Kiel, Weibel of Prague, Sellheim of Leipzig, and Hartman of Paris, stated that they had never seen this complication. Menge of Heidelberg replied that in forty years, during which time he had observed many cases, both of cancer of the uterus and of total prolapse, he had but once found the two conditions combined.

At the suggestion of George Gellhorn, we have reviewed the material at The Barnard Free Skin and Cancer Hospital, and found that in the past five years there have been 10 cases of complete prolapse of the uterus, 4 of which have been complicated by carcinoma of the cervix. The history of these 4 cases, in brief, is as follows:

CASE 1.—Mrs. V., white woman, aged forty-two years, had been operated upon elsewhere for prolapse fifteen years previously. She had a recurrence of her prolapse three years ago, and now presented the picture of complete procidentia. On June 3, 1932, a simple vaginal hysterectomy, with perineorrhaphy, was done under local anesthesia. The microscopic examination of the extirpated uterus revealed squamous cell carcinoma (Grade II) in a small ulcer from the posterior lip. The patient is still free from recurrence.

CASE 2.—Mrs. A., white, sixty-four years old, had been bleeding off and on for

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two years. The menopause had occurred twelve years prior to that time. The uterus was completely prolapsed and bore on its posterior lip a large, deep red, irregular proliferating growth. The diagnosis was between carcinoma and gumma. The latter possibility suggested itself because of the hardness of the growth, the strongly positive Wassermann, and the findings upon x-ray examination of an aneurysm of the aorta. On April 1, 1932, a vaginal hysterectomy was performed under local anesthesia. The assumption of a gumma was further strengthened by the fact that the tumor of the cervix did not bleed upon manipulation, and that the volsella did not tear out. After extirpation there was on bisection no tissue necrosis in the cervical wall; the latter appeared infiltrated and yellow in color. This discoloration, according to Gellhorn, is suggestive of syphilis. Subsequent microscopic examination, however, disclosed cancer, so that the possibility of malignant degeneration upon a syphilitic basis does not appear fanciful. The patient made an excellent recovery, but had a recurrence of the carcinoma in the vaginal wall ten months later. For this she is being treated with radium.

CASE 3.—Mrs. S., white, seventy-six years old, was first seen March 1, 1933, with an enormous total prolapse, exhibiting an immense decubitus ulcer of very hard consistency. Biopsy revealed a squamous cell carcinoma (Grade II). For this she was first treated with x-ray and radium, which caused a marked regression of the lesion. Operation was, however, out of the question at the time, because the patient had a very pronounced auriculoventricular heart block, with a blood pressure of 200/120. Only after she had been in charge of the medical department for a number of weeks could an operation be attempted. The latter was performed on May 9, 1933, and consisted of a vaginal hysterectomy under local anesthesia, which the patient withstood in very good condition, in spite of her advanced age and the serious cardiac complication. The histologic examination of the extirpated uterus still showed carcinoma.

CASE 4.—Mrs. A., white, aged seventy-four years, was operated upon one week after the patient in Case 3. She presented herself with a complete prolapse with ulcers about the external os. Biopsy from the ulcerated area revealed squamous cell carcinoma. On May 16, 1933, a Schauta vaginal hysterectomy was performed under local anesthesia, which the patient bore very well, even though the blood pressure was 180/90, and she suffered from chronic bronchitis.

These four cases suggest the following conclusions:

1. Carcinoma of the prolapsed uterus is not as rare as we have been led to believe. Of our 10 cases of complete prolapse, malignancy had developed in four. From this, one may infer that if biopsies were made of all decubitus ulcers of prolapsed uteri, many more cases of cancer would probably be discovered.

2. Most writers have tried to explain the rarity of cancer upon a prolapsed uterus, which we now know to be fictional, by assuming that the excessive hornification which takes place in the exposed mucosa acts as a protection against chronic irritation. This assumed protection, however, does not appear to us very convincing. In almost every case of procidentia there are single or multiple ulcerations, and even where the mucous membrane shows no gross destruction, the microscopic picture is that of a chronic tissue irritation. This is well illustrated in sections taken from the unbroken mucosa of a simple prolapse. We see here a marked hyperkeratosis, a thicken-

ing of the epithelial pegs with some downward growth and *quite a marked round cell infiltration of the subcutaneous tissue*. From such a picture and from an analogy with the frequent development of cancer upon the lower lip of the face, we are inclined to think that the excessive hornification incident to prolapse would favor the development of malignancy.

3. Apparently cancer upon a prolapsed uterus is not very active. This, if true, may be due to a number of factors. Prolapse is much more frequent in elderly women. The ages of our patients were sixty-four, seventy-four, and seventy-six years, respectively; and it is well known that cancer grows more slowly at advanced age. The prolapsed uterus, too, is atrophic, much more so than a senile uterus in its normal place. This means that the soil is not very favorable for rapid growth. With the eversion of uterus and vagina, the parametria run obliquely downward. Moreover, they are stretched and so are the lymphatics, which would mean that they are occluded to easy dissemination of cancer cells. All this may explain why in our first case, where the presence of carcinoma was not even suspected, no recurrence has thus far followed the simple vaginal hysterectomy; and it may account for the small number of recognized cases in the literature.

4. At any rate, we would suggest that this subject receive closer attention so that the frequency of cancer upon a prolapsed uterus can more accurately be determined on the basis of a large material.

5. Any case of cancer found upon a prolapsed uterus should first be treated by x-ray and radium, as the location of cancer makes radiotherapy particularly easy. From three to six weeks later a vaginal hysterectomy should be performed and the use of local anesthesia for this operation is of a special advantage, because many of these patients are of advanced age, or have other complications which render any other form of anesthesia dangerous.

Since submitting this paper for publication, Heidler (Zentralbl. f. Gynäk., December, 1933) reported three cases of cancer of the prolapsed uterus. Two of the patients had radical vaginal operations with good results, the third will be operated upon in the near future. Boukalik (AM. J. OBST. & GYNEC. 27: 620, 1934) had a patient with complete procidentia in which he discovered carcinoma of the cervix from a biopsy. Radium was used with no attempt to correct the prolapse.

REFERENCES

- (1) Pomtow, Gottfried: Inaug. Diss., Berlin, 1893. (2) Macleod, N. A.: Brit. M. J. 2: 12, 1926. (3) Kurtz, W.: Inaug. Diss., Tübingen, 1894. (4) Delvaux, F.: Bruxelles med. 11: 325, 1931. (5) Cullen, P.: Cancer of the Uterus, 1900, p. 183. (6) Williams, John: Harveian Lectures for 1886, p. 81. (7) Lahm in Halban-Seitz: Carcinoma of Prolapsed Uterus 4: p. 692. (8) Emmert, F.: J. A. M. A. 97: 1684, 1931. (9) Gellhorn, George: In Obstetrics and Gynecology, ed. by Curtis 2: p. 599, 1933.

KIDNEY FUNCTION IN PREGNANCY

III. WATER DIURESIS IN THE TOXEMIAS OF PREGNANCY

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IN A PREVIOUS report¹ the volume responses to a diuresis test were tabulated for a series of normal controls, both men and women, and a series of normal primiparas. In that report similar reactions on the part of a few patients suffering from toxemia of pregnancy were included, in contrast to the performance of the normal subjects. Table I, taken from that report, is reproduced, giving the figures of the normal pregnant group for reference and comparison.

The present report deals with a larger group of toxemic patients studied in a similar manner. The essentials of the test are the drinking of 1,200 c.c. of water in six half-hourly doses of 200 c.c. each, and the collection of eight specimens of urine over a period of four hours from the first dose of water. The specimens are examined for volume, specific gravity, and if desired, for urea, chloride, and other substances. It is unnecessary to elaborate the method further here; the details are fully set forth in the previous report and have been strictly adhered to in the present series.

The patients in the present group, with the exception of one private case, were studied through the Toxemia Clinic of the Massachusetts Memorial Hospitals. Not all of the patients of the clinic have been subjected to the diuresis test, but all who have been are included in the group here reported. The material consists of 62 tests among 35 patients. All of these patients have been carefully gone over in the course of their toxic studies, most of them very completely. Some tests, however, have necessarily been omitted because of the therapeutic demands of the patient's condition, or because of lack of cooperation. The planned study of the toxemias of pregnancy is quite elaborate. It includes a special and detailed history and physical examination, blood morphology and chemistry, serologic tests, the routine urine examinations, the phenol-sulphonephthalein and Mosenthal tests, basal metabolism, vital capacity, determinations of blood phosphorus, calcium, and fibrinogen, eyegrounds and visual fields, the sugar tolerance, duodenal lavage for liver function, if possible, and other examinations as indicated. The program contemplates such a study when the patient is recognized as a probable

toxemic, a repetition postpartum before leaving the hospital, and a second repetition six months postpartum. In spite of some incompleting tests in this series, it is fair to say that in all instances these patients have been studied sufficiently carefully to classify them as toxemics or as nontoxemics. In this series of 35 cases 6 were classed as nontoxemics, and are here used as a contrast group to the toxic patients and to the normal pregnant group.

No effort will be made here to record the complete results of the toxic studies on these patients. Those studies will be presented elsewhere. Neither will any effort be made to subdivide the patients too closely with respect to liver and kidney involvement. Because of the small numbers this must be in the nature of a preliminary report.

Seven groups have been included: first, the normal pregnant controls in the final four weeks of pregnancy; second, the normal pregnant controls in the first two weeks postpartum; third, the normal pregnant controls nine weeks or more postpartum. These will serve as the basis of comparison for the other groups in the antepartum, postpartum, and late postpartum tests. The fourth group includes those patients suspected of being toxemics, but who were proved, after study, to be suffering from other conditions; fifth, patients diagnosed as low reserve kidney and chronic nephritis; sixth, those diagnosed as preeclampsies; and seventh, those who had had convulsions, ante-, intra-, or postpartum.

The antepartum performance of these various groups is to be compared with the first, the performance of normal pregnant patients in the last four weeks of their pregnancy. As already reported, this value is 905 c.e. of urine under the conditions of the test. The two groups of the present series which most nearly approach this total are the nontoxic group with an average volume of 679 c.e. and the group of low reserve kidney and chronic nephritis with a total of 713 c.e. The former of these two groups included 6 patients and 7 tests, and there is a marked spread between the low and high individual volumes. This is to be expected in such a catchall group and will probably become still more pronounced as the numbers grow. The other group includes 2 cases of low reserve kidney and 7 of chronic nephritis. The adherents of Stander's classification² of the toxemias may think it strange to group these two conditions together. They are both, however, types of kidney decompensation depending on overload. The former is predicated on a poor organ, while the latter results from previous damage. The question of previous damage is not of first importance in the present treatment of the patient. The essential point is the decompensation and the extent of the discrepancy between demand and capacity.

The next group includes the preeclampsies. The antepartum performance of these patients averaged 411 c.e., less than half of the volume voided by the normal pregnant patient in the last four weeks of

her pregnancy. In this connection it must be noted that, of the 14 tests done, most were performed considerably prior to the date of expected confinement. The time of these tests ranged from two to twenty-five weeks antepartum, and averaged eight weeks. This group should fairly be compared, then, to control patients of a corresponding time antepartum. In the report above referred to¹ (Table I) the tests done in the period of from eight to five weeks antepartum showed an average output of 1,110 c.c. of urine. On this basis the lowering in volume among the pre-

TABLE I. NUMBER OF CASES, PLUS OR MINUS DIFFERENTIAL BETWEEN VOLUME INGESTED AND ELIMINATED AND THE PERCENTAGE ELIMINATION OF THE VARIOUS GROUPS COMPARED TO THE COMBINED AVERAGE OF THE CONTROL GROUPS

	NO.	INGESTED	ELIMINATED	DIFFERENTIAL	PERCENTAGE OF NORMAL OUTPUT
<i>Controls, normal nonpregnant:</i>					
Studied	10	1,200	1,384	+184	
Assumed	10	1,200	1,316	+116	
Combined	20	1,200	1,353	+153	100
<i>Normal pregnancy:</i>					
Thirty-sixth to thirteenth week antepartum	11	1,200	1,389	+189	103
Twelfth to ninth week antepartum	9	1,200	1,043	-157	78
Eighth to fifth week antepartum	20	1,200	1,110	- 90	82
Fourth week antepartum, delivery	38	1,200	905	-295	67
Delivery—fourth week postpartum	17	1,200	940	-260	70
Fifth to eighth week postpartum	12	1,200	1,099	-101	81
Ninth week postpartum on	5	1,200	1,259	+ 59	92
Toxemias	6	1,200	225	-975	17

eclamptic patients is about 63 per cent, instead of 46 per cent, as in the comparison with the control performance during the last month antepartum. One patient in this group had the test improperly performed in that she received 1,600 c.c. of water instead of 1,200. Her urine volume, however, amounted to only 88 c.c., so that the error in technic confirms, rather than nullifies, the result.

The last group of the series contains the eclamptics. There are three patients and only one was studied antepartum. In spite of three convulsions she insisted on conservative treatment because of religious considerations, and during her antepartum stay she had two diuresis tests. In the first test she was given 1,800 c.c. of water instead of the regulation 1,200 c.c. Even on this basis her output was 146 c.c. This test was performed twelve weeks antepartum. The second test, done three weeks later, was properly done and resulted in a volume of 188 c.c. This group of patients is, of course, the hardest in which to obtain tests. The number of eclamptics is small, owing to more efficient prenatal care, and many of the convulsions occur intra-, or, as in two of this group, post-

partum. Neither of these two was studied before delivery. The opportunities for extensive antepartum study are further cut down by the urgency of treatment, which in many cases makes delay for study too risky to be justified.

The performance of the above groups has been tabulated in Table II, and graphically represented in Fig. 1.

Table II and Fig. 2 show the results of the test in the same groups during the second week postpartum. The control curve (2) shows a volume of 940 c.e. for the

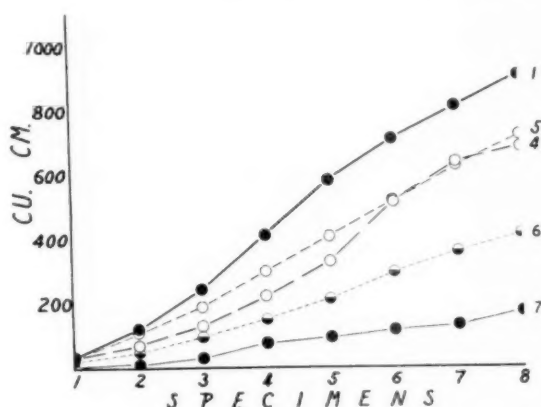


Fig. 1.—Summation curves of the various groups of patients antepartum. The numbers at the right refer to the group indicated in Table II.

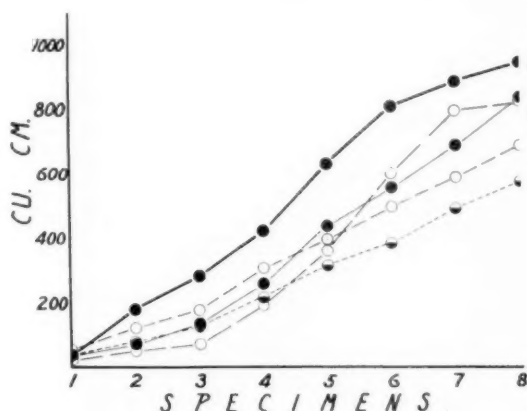


Fig. 2.—Summation curves of the various groups of patients approximately two weeks postpartum.

normal pregnant patients. The nearest approach to this level is found in the eclamptic group, whose average is 829 c.e. The nontoxic group is next best with an output of 810 c.e., while the chronic nephritic patients averaged 683 c.e., and the pre-eclampsies showed the poorest recovery at this stage, with a volume of 511 c.e.

Table II and Fig. 3 show the curves of the various groups at approximately six months postpartum. These are too few in number to bear close scrutiny, but they are interesting in showing the recovery of the preeclampsies and eclampsies to the full power of water diuresis.

TABLE II. WATER DIURESIS IN TOXEMIAS OF PREGNANCY, GIVING THE DATA ON THE VARIOUS GROUPS OF CONTROLS AND PATIENTS DEALT WITH IN THIS REPORT

	NO.	ANTEPARTUM										Σ	NO.	0-2 WK. P. P.					Σ	NO.	6 MO. P. P.					Σ					
Normal Controls 4-0 Wk. A. P.	38	30	90	120	170	170	125	105	95	905																					
Normal Controls 0-2 Wk. P. P.											17	40	140	100	140	210	175	75	60	940											
Normal Controls 9 Wk. + P. P.																					5	10	110	220	280	240	150	190	59	1259	
Nontoxic	7	33	34	65	87	107	187	121	45	679	1	25	30	20	120	165	240	195	15	810											
Low Reserve Kidney Chronic Nephritis	9	29	63	95	108	110	114	101	93	713	5	59	64	57	122	97	96	90	98	683	2	62	220	170	125	163	147	83	100	1070	
Preeclampsia	14	21	26	49	54	60	81	68	52	411	14	38	43	48	80	108	65	108	81	571	3	60	200	260	228	238	178	120	47	1329	
Eclampsia	2	0	10	20	47	16	22	16	38	169	4	48	24	67	120	177	118	129	146	829	1	95	80	195	193	180	195	255	160	1353	

It has long been recognized that there is a reduction in urine volume in eclampsia, and that complete suppression was one of the sequelae to be feared. So far as we have searched, however, we have found no quantitative observations to support this belief. Such observations, if they have been made, have never received any wide recognition. They are not mentioned by Williams³ or DeLee⁴ or in the other standard obstetric textbooks, nor are they noted in such detailed résumés of the toxemias as those of Kosmak⁵ and Stander.² DeWesselow and Wyatt,⁶ in their monograph, make mention of a test similar to the one here used, and allude to the lowering of urine volume encountered in the pre-eclamptic and chronic nephritic patient. They give no figures, how-

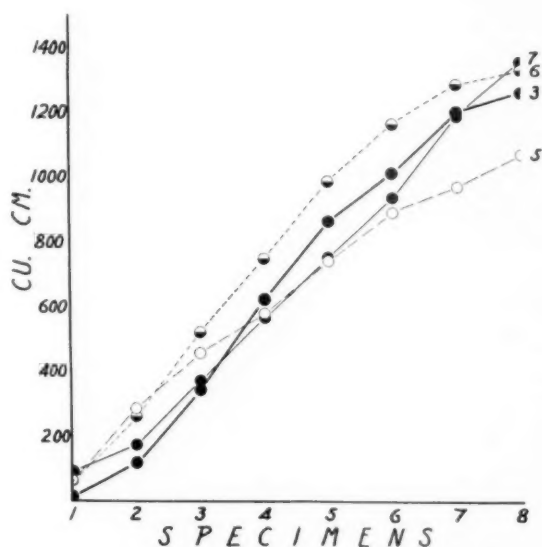


Fig. 3.—Summation curves of the various groups of patients about six months post-partum.

ever, to show the extent of the loss of function. Here we have offered such figures, which corroborate the older empirical observations.

So far as the time relationships go, there seems to be no way to satisfactorily correlate normal pregnancy with the toxic groups. The former can be split into definite time compartments from the earliest observations in pregnancy, through the whole antepartum period. The toxic patient, however, is tested when she shows symptoms, and these may vary markedly in time of appearance. The tests of all the toxic groups averaged eleven weeks antepartum.

The average curves of the various groups may be drawn either as summation curves, which are more convenient if we are concerned only with the total volume, or may be plotted by placing the average of the individual collections in their appropriate places as in Figs. 4 and 5.

The latter method gives more of the characteristics of kidney activity and suggests possibilities relating to the etiology and mechanism of the various kinds of toxemia. In order to show the characteristic response of the normal kidney, the curve of nonpregnant individuals is shown in Fig. 4. This curve, marked *O*, is characterized by a rapid rise to its peak after the water has been about half ingested. There is rather a plateau for the next two collections. This finishes the inges-

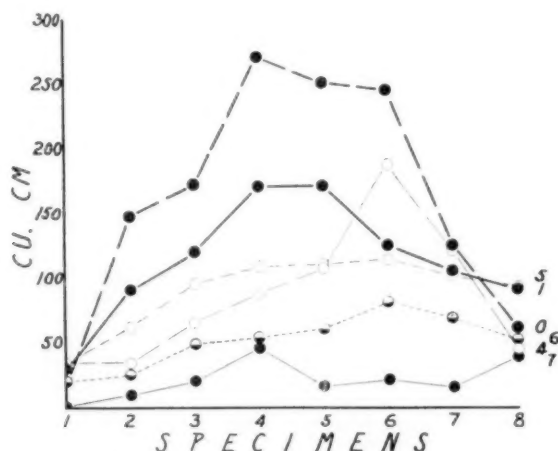


Fig. 4.—Simple curves of the same groups as shown in Fig. 1. The curve marked *O* is the average response among normal nonpregnant subjects.

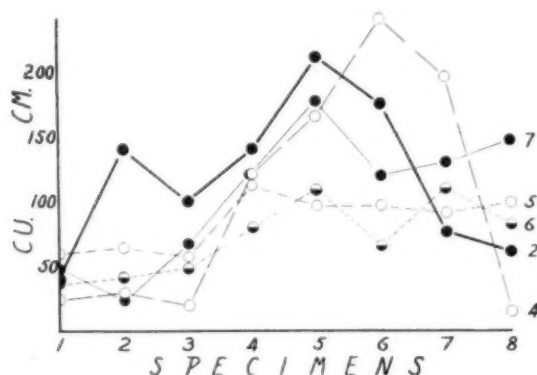


Fig. 5.—Simple curves of the same group as shown in Fig. 2.

tion of water, and is followed by a successive drop in the volumes of the remaining collections. The total volume excreted during the test averages 1,290 c.c., the full amount ingested plus approximately the amount of water metabolized in four hours. Reference to Figs. 4 and 5 will show that the control curves of normal pregnant women for the last four weeks before delivery and during the second week postpartum approximate the shape of the nonpregnant curve, although they are lower in volume. When we contrast with these curves those of the

chronic nephritic group, we are struck at once with the flattening of the latter and the inability, either ante- or postpartum, to excrete water rapidly. This corresponds to clinical experience with the Mosenthal and other concentration and dilution tests in chronic nephritis. The antepartum curve of the eclamptics is also very flat, but the postpartum curve, in contrast to it, and in contrast also to the curve of the chronic nephritic, approaches much more closely, both in shape and in volume, the control curve of the normal pregnant group.

These variations in the shape and the volume of the curves suggest that the important causative agent in the nephritic group is some intrarenal, semipermanent (or permanent), organic damage, while in the eclamptic group the causative factor is extrarenal. This is also strongly indicated by the rapidity and extent of the recovery in the first two weeks postpartum. This situation might well correspond to the pseudonephritis which may accompany thyroid failure, and which yields rapidly to thyroid medication. When we turn to the curves of the preeclamptic group we find that the indications are not so clear-cut. Though these cases have usually been considered the same as eclampsia in character but of less severity, these curves do not bear out this supposition. The newer concept of eclampsia, however, may offer a reasonable ground for the reconciliation of this seeming discrepancy.

The importance of the shape of the curve may be stated in another way. The excretion of water may be directly affected by at least two mechanisms. The first is the efficiency of the kidney as an organ. The second is the interference with water transport to the filtration surfaces of the kidney, from whatever cause. Obviously, a kidney, no matter how capable, cannot produce a large volume of urine if the body fluids are not brought to it. A curve of diuresis which has a high volume for at least one specimen proves that the kidney can handle water if the transport of fluid to it is not impaired. Though the reverse is not necessarily true, the lack of any large collection in a test points suspicion at the kidney. In the chronic nephritics, where there is loss of permeability and other signs of organic damage, we are fairly justified in believing that the shape of the curve is due to intrinsic factors in the kidney. Among the eclamptics, however, we have no demonstrable loss of permeability, and the speed of recovery seems too fast for an organic lesion in the kidney.

No cases of acute yellow atrophy or pernicious vomiting have been studied.

SUMMARY

The present report is based on a series of patients suffering from the various toxemias of pregnancy, who have been tested for their powers of water diuresis. The clinical observation of lowered urine volume in

the toxemias has been amply substantiated by these quantitative methods, and the response of the various groups has been compared. The numbers are too small for final evaluation, but the variations of the several groups are striking enough to be very suggestive.

REFERENCES

- (1) Janney, J. C., and Walker, E. W.: J. A. M. A. 99: 2078, 1932. (2) Stander, H. J.: The Toxaemias of Pregnancy, Baltimore, 1929, Williams & Wilkins Co. (3) Williams, J. W.: Textbook of Obstetrics, New York, D. Appleton & Co. (4) DeLee, J. B.: The Principles and Practice of Obstetrics, Philadelphia, Saunders & Co. (5) Kosmak, G. W.: The Toxaemias of Pregnancy, New York, 1922, D. Appleton & Co. (6) DeWesselow, O. L. V., and Wyatt, J. M.: Modern Views on the Toxaemias of Pregnancy, New York, 1925, Hoeber.

THE SEDIMENTATION RATE AND SCHILLING INDEX IN PREGNANCY*

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THE increase in the sedimentation rate of the erythrocytes in disease and in pregnancy has been known for a long time. John Hunter observed the increased tendency of the erythrocytes to settle out in the presence of infection in his study of gunshot wounds. It was also known to Hippocrates and to Galen.

Fahraeus¹ was the first to study the sedimentation rate in pregnancy. It was suggested that it might be used as a means of diagnosis of early pregnancy. The utilization of the test as a valuable aid in the diagnosis and prognosis of disease is relatively recent. Since 1918, however, numerous reports have brought out the undoubted importance of this laboratory procedure. Especially in gynecology has it become a most important adjunct, as shown by Baer and Reis² and others. Fahraeus³ has given us a small series of sedimentation tests during the various months of pregnancy and the puerperium.

Because of the fact that there is a "physiologic" increase in the sedimentation rate during pregnancy and the puerperium, the test means little in the presence of these conditions. It occurred to us that if the normal "physiologic" increase were known in all stages of normal pregnancy, then we might have a standard by which to gauge some disorders superimposed upon the gravid state. Also, any finding during pregnancy which shows such a marked deviation from the normal, as does the sedimentation rate, deserves a thorough study if we are to have a complete knowledge of that intricate condition of women. With much the same idea in view, and also as a check on infection in our series of cases, Schilling counts were also done.

*Read at meeting of the Obstetrical Society of Philadelphia, March 1, 1934.

Authorities are not in agreement as to the physicochemical changes in the blood bringing about a rapid sedimentation rate. Bochner, et al.⁴ reviewed the various theories underlying the sedimentation velocity: Stoke's law of suspension stability and sedimentation velocity states "the sedimentation velocity of the corpuscle in a suspension of globular elements in fluid is proportionate to the square of their radius." By capillary studies, Linzenmeier⁵ observed granular bodies evenly distributed in the circulation of normal individuals, but in patients with high fever or in parturient women, the granules were coarse and unevenly distributed with clumping and rouleau formation of the cells. Fahraeus⁶ believed the clumping and rouleau formation which he observed, took place about a red blood cell which had undergone autohemolysis. Then there are the electrophysical theories. The red blood cell wanders to the anode and thus carries a negative charge. There is an interference with blood current, due to loss of potential, associated with serum globulin changes, in disease or pregnancy, and the travel of an erythrocyte to the anode is slower.⁷ Variations in fibrin content, globulin, and the cholesterol lecithin ration are thought to be factors, probably by their influence on the electric potential of the cells.

METHOD

In order to establish a normal standard only healthy women were selected. All patients with elevation of blood pressures, colds, pathologic urine, or excessive vaginal discharge were excluded, or grouped separately. Monthly tests were carried out on the same women so far as it was practicable. A Dare hemoglobin reading was taken coincident with each sedimentation test in order to rule out anemia, and a blood spread for Schilling count was made. This latter was done partially as a check against the presence of infection and partially to see if there should be any interesting variations in the index. This work was carried out at the Kensington Hospital for Women under the direct supervision of Dr. Edward A. Schumann.

The method selected for use was that of Weiss.⁸ This can well be standardized and offers the important advantage that the blood is taken directly into citrate solution and has no tendency to clot in the act of taking. Four-tenths cubic centimeters of sterile 3 per cent sodium citrate in a 0.85 per cent sodium chloride solution is taken up into a syringe. The needle is then introduced into a vein, tourniquet immediately released, and blood aspirated to the 2 c.c. mark. The blood is well mixed in the syringe and finally placed in a special 2 c.c. cylinder. The cylinder is graduated from 1 to 100 so that the readings are made in percentage of the fluid column. Readings are made every fifteen minutes for one hour. The normal sedimentation time by this method is from 3 to 5 per cent in forty-five minutes. Women normally have a slightly more rapid sedimentation rate than men.

In all, 150 tests were made from the third month of gestation to the fourth week postpartum inclusively. Of this number 24 were excluded altogether because of pyelitis, purulent cervicitis, and severe anemia. The sedimentation rate in these patients was definitely more rapid than the average normal for the normal pregnant women. Fifteen tests are herein considered separately and grouped under toxic patients. These patients might be classified as preeclampsies or patients with, for the

most part, mild nonconvulsive toxemias, as indicated by elevations of blood pressure in the later months, albuminuria and some subjective symptoms such as blurring of vision, edema, headaches, etc.

Table I gives the data on the normal pregnant women grouped in months of gestation. It will be noted that there is a progressive increase in the rate of sedimentation with the progression of gestation. This is graphically shown in Fig. 1. The normal for nonpregnant women⁵ is also given for comparison. Table I also shows the postpartum

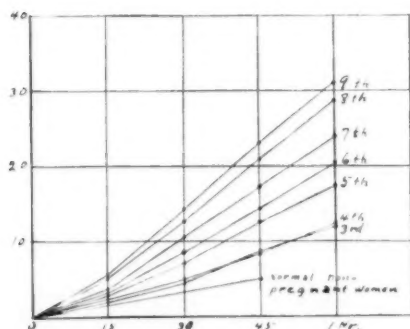


Fig. 1.

Fig. 1.—Composite chart showing graphically the average sedimentation rate of normal pregnant women, from the third to the ninth months of gestation, as compared with the normal.

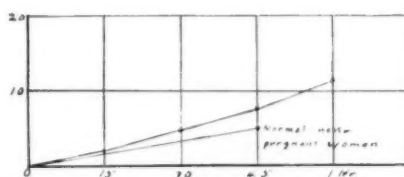


Fig. 2.

Fig. 2.—Average sedimentation rate of 11 normal women from twenty-one to twenty-seven days after a term delivery. The normal for nonpregnant women is given for comparison.

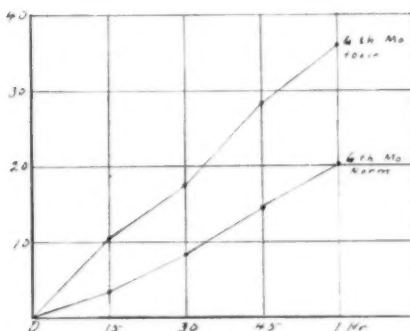


Fig. 3.

Fig. 3.—Average sedimentation rate of 4 toxic patients in the sixth month of pregnancy as compared with the average for the normal group in the sixth month.

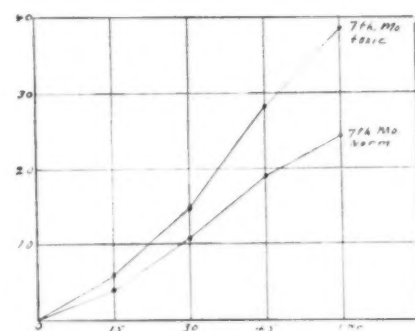


Fig. 4.

Fig. 4.—Average sedimentation rate of 2 toxic patients in the seventh month of pregnancy as compared with the average for the normal group in the seventh month.

group, taken from twenty-one to twenty-seven days after delivery and nonmorbid recovery. The graph (Fig. 2) shows the rapid return to almost normal by the fourth week postpartum.

Table II gives the data on the toxic patients by months of gestation. Figs. 3 to 6 inclusive, show the relatively more rapid average rate of sedimentation of this group as compared with the normal patients

in the corresponding stage of gestation. A study of these tables will show that some of the blood pressure readings are normal. Such tests were included here because of the fact that the sedimentation rate was unusually rapid, and the same patients later developed toxic symptoms and elevations of blood pressure. Patient S. G. ran a consistently rapid sedimentation rate, but showed no toxic symptoms until the ninth month. This was also shown by patient B. B. Two toxic patients in Table II had sedimentation rates practically normal for the ninth month of pregnancy. Both had intensive eliminative treatment before the tests were made. It is possible that hydremia along with some protein, globulin, and lecithin changes may be a factor in the rate of sedimentation of the erythrocytes. No relation to parity was noticed in either group.

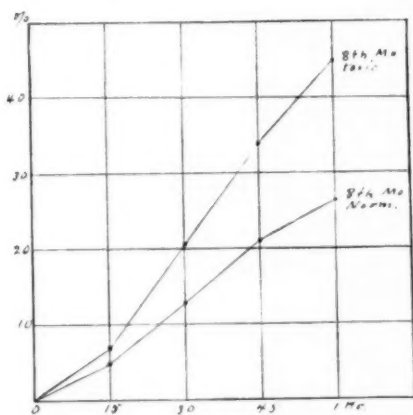


Fig. 5.

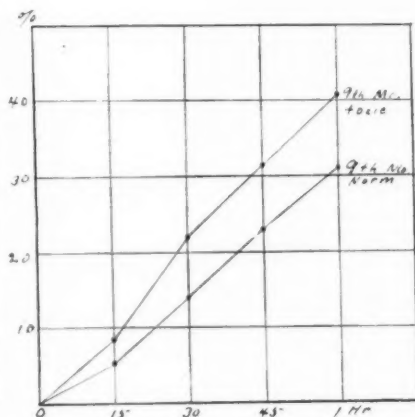


Fig. 6.

Fig. 5.—Average sedimentation rate of 3 toxic patients in the eighth month of pregnancy as compared with the normal group in the eighth month.

Fig. 6.—Average sedimentation rate of 5 toxic patients in the ninth month of pregnancy as compared with the average for the normal group in the ninth month.

The average Schilling counts are tabulated in the above tables along with the sedimentation rates. Just criticism may be offered that total white counts were not done in this series. However, the well-established "physiologic leucocytosis of pregnancy" from numerous previous investigations makes it seem unnecessary of repetition. It will be noted that there is a regenerative type of bone marrow activity as shown by the presence of a few metamyelocytes, and an occasional myelocyte. This tendency does not increase noticeably with the months of gestation (Table I).

Arneth⁹ found shifts to the left or the appearance of new forms during pregnancy. Baer¹⁰ made similar observations as regards the Arneth classification. The Schilling index does not involve as fine divisions of the granulocytes as does the Arneth scale, but our results are comparable to these findings.

TABLE I. SEDIMENTATION RATE AND SCHILLING COUNTS ON NORMAL WOMEN IN THE THIRD TO THE NINTH MONTHS OF GESTATION, AND FROM TWENTY-ONE TO TWENTY-SEVEN DAYS AFTER TERM DELIVERY AND NORMAL RECOVERY. ONLY THE AVERAGE OF EACH GROUP IS GIVEN

MONTH	NO. TESTS	SEDIMENTATION RATE %				HB.	POLY.	BAND.	META.	SCHILLING'S			EOS.	INDEX
		15 MIN.	30 MIN.	45 MIN.	1 HR.					MYELO.	LYM.	MONOCY.		
Third	5	2.1	4.6	8.6	12.1	84.0	74.0	0.8	0.6	0.3	23.4	1.2	0.6	0.7%
Fourth	8	2.2	4.8	8.5	12.3	78.0	69.0	2.0	1.8		25.0	0.6	0.6	3.2%
Fifth	12	2.9	7.4	12.5	17.4	73.0	73.0	2.7	2.0		24.8	1.3	0.2	2.9%
Sixth	20	3.4	8.5	14.4	20.4	78.0	72.0	2.7	1.6	0.35	21.7	0.6	0.45	2.7%
Seventh	24	3.8	10.6	17.4	24.0	75.0	68.2	4.9	2.0	0.4	23.6	0.5	0.2	3.3%
Eighth	17	5.0	12.7	21.0	28.8	71.6	68.0	6.1	1.8	0.6	22.0	0.5	0.2	3.2%
Ninth	14	5.3	14.0	23.0	31.0	72.0	68.0	5.6	2.2	0.71	23.0	0.5	0.1	3.9%
Postpartum	11	1.9	4.6	7.4	11.0	72.0	62.4	3.7	1.2		32.0	0.7		1.6%

TABLE II. TOXIC GROUP (15 TESTS)

PT.			SEDIMENTATION RATE %					SCHILLING'S							EOS.	INDEX	
			GRAV.	MO.	15 MIN.	30 MIN.	45 MIN.	1 HR.	HB.	B.P.	POLY.	BAND.	META.	MYELO.			LYM.
S. G.	1	5	7	20	28	33	69	110/60	79	2	2			16		1	2.4%
	1	6	5	17	30	40	87	112/80	73	2				25			5.7%
	1	6	5	15	24	33	70	120/50	68	2	4		1	18	6		
5	6	8	23	39	39	75	140/76	74					26				
P. P.	3	6	4	15	25	32	72	200/130									
Average				6th	5.5	17.5	28.3	36	76	71	1.3	1.3		19.6	2	0.3	1.9%
S. G.	1	7	8	18	31	40	78	100/70	78	7	1			14			1.1%
	7	7	3	11	25	37	70	130/80	66	5	2			27			2.7%
J. S.																	1.9%
Average				7th	5.5	14.5	28	38.5	74	72	6	1.5		20.5			
S. G.	1	8	9	22	37	49.5	70	120/70	66	3	2			27	1	1	2.9%
	3	8	7	21	33	41.0	75	148/84	75	7	6		3	9			10.0%
	5	8	4	18	33	43.5	70	120/80	70	3	1		0	26			1.3%
Average				8th	6.6	20.3	34.3	44.7	70.3	4.3	3	3	1	20.6	0.3	0.3	4.7%
S. G.	1	9	13	35.0	45	52.0	70	140/90	73	7	3		1	16			5.0%
	1	9	10	24.0	38	47.0	63	158/100	65	11	1		1	22			2.6%
B. B.	5	9	8	20.0	32	40.0	70	144/90	54	5	5		1	37	3		1.7%
	5	9	6	17.0	26	35.5	72	160/90	79	7	3		1	10			4.6%
W. Z.	1	9	6	17.0	26	35.5	72	160/90	79	7	3		1	10			
F. V.	1	9	5	12.5	15	28.0	75	164/110	79	2				19			
Average				9th	8.4	21.7	31.2	40.5	70	70	6.4	1.4	0.8	20.8	0.6		3.4%

SUMMARY

The sedimentation rate of the erythrocytes increases progressively with each month of normal pregnancy. The rate in the ninth month is approximately five times that given for the average normal nonpregnant woman.

There is a return practically to normal by the fourth week after delivery.

A group of patients with toxic symptoms showed more rapid sedimentation rates than the average for normal pregnant women in the same month of gestation. The average readings were from 10 to 15 points higher by the percentage method of recording.

There is a mild regenerative type of activity of the bone marrow during pregnancy, as shown by the Schilling index.

REFERENCES

- (1) *Fahraeus, R.*: Hygiea 80: 369, 1918 and 70: 1900, 1918. (2) *Baer and Reis*: Tr. Am. Gynec. Soc., Philadelphia 1: 291, 1925. (3) *Fahraeus, R.*: Acta med. Scandinav. 55: 70, 1921. (4) *Bochner, M., and Wassing, H.*: J. Lab. & Clin. Med. 11: 214, 1925. (5) *Linzenmeier, G.*: Ztschr. f. ärztl. Fortbild. 20: 445, 1923. (6) *Fahraeus, R.*: Acta med. Scandinav. 9: 12, 1921. (7) *Hober and Mond*: München. med. Wchnschr. 69: 1617, 1922. (8) *Weiss, A.*: Am. J. M. Sc. 181: 379, 1931. (9) *Arneth, J.*: Arch. f. Gynäk. 74: 145, 1904. (10) *Baer*: Surg. Gynec. Obst. 23: 567, 1916. (11) *Adachi, S.*: Beitr. z. Geburtsh. u. Gynäk. 17: 174, 1912.

DISCUSSION

DR. PHILIP F. WILLIAMS.—To me the important point of Dr. Griffin's paper is that he has continued the establishment of standards of the various tests, in this instance, the sedimentation rate by progressive periods in pregnancy. I am sure that there are some other tests, for instance urea clearance, which could be done in a large series of cases at intervals in pregnancy. We would then have more exact standards from which to determine deviations in studies of toxemia. There are a number of factors in pregnancy which may influence the progress of sedimentation which he demonstrates, namely, the lowering of surface tension, increase in serum globulin and increase in fibrinogen. Particularly in the latter two might there be an application to the results obtained in his toxemia group. I feel that a comparison of blood volume and sedimentation time would be an interesting finding in the continuance of this study; undoubtedly hydremia must play a part in the results obtained.

It would be interesting to note the influence of dehydration treatment in toxemia on the sedimentation time of such cases. All conditions which are characterized by marked protein destruction seem to influence a more rapid sedimentation. This too might possibly account for the findings in toxemia. What influence the intra-uterine death of the fetus might have could also be ascertained.

MACROCYTIC HYPERCHROMIC ANEMIA IN PREGNANCY*

WITH THE REPORT OF A CASE AND A REVIEW OF THE LITERATURE

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IT IS now generally agreed that the anemias occurring during pregnancy, excepting those associated with postpartum hemorrhage and infection, fall into three groups: (A) Physiologic anemia of pregnancy. The hydremia occurring in normal pregnancy results in an apparent small decrease in red cells and hemoglobin, but this is no true anemia. (B) Microcytic hypochromic anemia. This is characterized by a color index below 1, and a blood picture resembling a secondary anemia. The Price-Jones index, which is a curve constructed on the measured diameters of 500 red blood cells, falls to the left. It probably represents the results of iron withdrawals on the part of the fetus and responds well to iron medication. This type of anemia exists in from 30 to 40 per cent of all pregnant women. (C) Macrocytic hyperchromic or primary anemia.^{7, 8} This is characterized by a color index above 1 and by a blood picture which resembles, and sometimes cannot be distinguished from, a true Addisonian anemia. The Price-Jones index shows the cells to average above normal in size, and so lies to the right of normal.

The first two groups are exceedingly common. The last group, while seen frequently in certain climates, is rare in the temperate zone. Because this disease is uncommon, the following case is reported in summary.

Mrs. E. D., white, aged twenty-seven, became pregnant about the first of December, 1932. She had had one previous pregnancy which was perfectly normal. Her previous medical and surgical history was negative. During the first six months of the present pregnancy she was quite well but at about the twenty-fourth week began to suffer from marked heart burn. About the thirty-fourth week of her pregnancy she began to have persistent and progressive diarrhea accompanied by abdominal soreness, attacks of vomiting and progressive weakness. On admission to the hospital in the thirty-sixth week of her pregnancy she had tachycardia and a low fever. Examination of the blood showed a marked anemia and a color index above 1, R.B.C. 1,970,000, hemoglobin 55 per cent, W.B.C. 5,050, polymorphonuclear leucocytes 63 per cent, lymphocytes 33 per cent, mononuclears 4 per cent, normoblasts 2 per 100, and platelets 110,000. The leucopenia and the relative lymphocytosis suggested that the anemia was aplastic. On the fourth day the patient was delivered of a premature infant with little blood loss. She was transfused during labor. On the third day postpartum there was an acute crisis characterized by a fever of 104.8° F. and a pulse of 144, marked asthenia and a W.B.C. of 900 with 70 per cent lymphocytes and 30 per cent polymorphonuclear leucocytes. She was transfused and this was repeated twice again in the next three days. She was given large doses of liver extract intramuscularly. Small doses had been used previously.

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Following this the gastrointestinal symptoms improved but did not cease until the eleventh day postpartum. During this time examination of the vomitus showed absence of hydrochloric acid. Blood cultures performed on the patient at the height of the fever were reported negative. The reticulocyte response was not as marked as would be expected but this may have been due to the aplastic bone marrow. A blood count done on the thirteenth day postpartum showed R.B.C. 4,500,000, hemoglobin 97 per cent, W.B.C. 13,600, polymorphonuclear leucocytes 76 per cent, and reticulocytes 1.9 per cent. Her blood count on the eighteenth day postpartum showed R.B.C. 3,500,000, hemoglobin 83 per cent, W.B.C. 14,500, polymorphonuclear leucocytes 85 per cent, platelets 184,000, and reticulocytes 7.3 per cent. The patient was discharged on the nineteenth day postpartum and was kept on liver therapy for about two months. She is at the present time in excellent health and has received no treatment for the past six months. Her blood picture is normal except for a slight lymphocytosis. The gastric acidity is normal.

The occurrence of a severe anemia in pregnancy was first noted in 1842 by an American, Channing,¹ who included 12 cases of this type in a paper on the general subject of anemia. Some critics have stated that several of these cases were due to puerperal sepsis but a review of the reported cases, together with the fact that he obtained autopsies on several, makes one believe that Channing was describing a true primary anemia. He was without any means of accurately measuring the extent of this anemia but speculated on the probable value of transfusion. Other case reports followed. Osler³ attempted to classify these cases in 1919. In 1924, Bardy⁴ collected 68 cases from the literature of Europe and America occurring over a period of thirty-eight years. Since then many papers have appeared which are of great interest, especially those based on material from India.

This type of anemia is common in the tropics but is most exceptional in the temperate zone. Gupta¹⁶ quotes combined figures from Vienna, Dublin, London, and Edinburgh showing an incidence of about $\frac{1}{10,000}$. In India the incidence is estimated at $\frac{29}{1,000}$, or about 300 times as great.

Various causes have been assigned to this condition. Many of them are mainly theoretical. Gupta¹⁷ feels that it is due to the invasion of the blood by hemolytic organisms present in the gastrointestinal tract. Mitra¹⁶ states that it is due to the absorption of intestinal toxins. Adler¹⁸ believes that this anemia represents the reaction of a previously damaged bone marrow. Balfour¹⁶ feels that it is due to a toxemia arising from the products of conception. Hofbauer⁶ is quoted as believing that it is due to a placental hemolysin.

Observers in India¹⁹ feel that there are several predisposing factors that may explain the large incidence in this country. The prevalence of a mild degree of anemia in the nonpregnant state is shown by two observers who report blood counts which average 3,500,000 and 4,000,000. The diet in India is markedly deficient in many respects, particularly in proteins and minerals, and in vitamins A, C, and D. Wills^{12, 13} has produced a macrocytic anemia in monkeys with a diet deficient in these elements. She found that vitamins A and C failed to protect the animals but that the addition of "Marmite" (brewers' yeast) cleared up the anemia. She applied this fact clinically with success.¹⁹ The time of onset of the disease, which is generally in the last trimester, would lead one to believe that the demands of the fetus for large amounts of various materials at this time might be related to the cause. This, however, seems a more likely explanation of the hypochromic or secondary type of anemia.

Castle and Straus^{20, 21} have studied carefully six cases of anemia of the primary type in pregnant women, and conclude that there is much evidence to show that the

mechanism of production is exactly similar to true pernicious anemia. In two cases they show evidence that the intrinsic factor of blood formation is lacking in the gastric juice. They feel that they will be able to show that this factor returns permanently following the termination of pregnancy, thus differing from true pernicious anemia. This bears out the clinical observation of Osler³ who stated that "the main difference from real pernicious anemia lay in complete recovery." Larrabee⁶ also states that the first cases seen by him were diagnosed as pernicious anemia and only after he had followed them for years without relapse did he realize their true nature. Therefore the cause of this anemia may be stated to be related to that of true pernicious anemia, but to be unknown. Castle and Straus²¹ feel that the Indian reports of cures with "Marmite" show that certain cases may be due to absence from the diet of the extrinsic factor for blood formation. The latter is supplied by the large quantities of vitamin B found in brewers' yeast.

The onset of this anemia is usually in the last trimester or close to term and may be sudden or gradual. Many of the reported cases show unmistakable symptoms during the last month of pregnancy but the anemia was discovered only late in the puerperium. Therefore this disease is called puerperal anemia by some authors. In Balfour's¹⁶ series of 150 cases, 75 began with low fever, 58 with diarrhea, and 17 with edema and weakness. Fever was present in some part of the course in 125 or 83 per cent. It is interesting to note that he states that a marked exacerbation of fever frequently occurs on the second or third day postpartum. Mitra¹⁶ states that 71 of his 86 cases had soreness of the tongue and mouth. Dyspnea is frequent. Many show tachycardia.¹⁴ Discoloration of the skin is not present as a rule and Balfour¹⁶ definitely states that he has never seen the lemon yellow tint of Addisonian anemia. Larrabee⁶ states that both liver and spleen may be palpable but these are not constant findings. While tingling of the hands and feet are often present, spinal cord lesions¹⁵ have never been noted. Examination of the blood shows a marked anemia with a high color index and Price-Jones index falls to the right. The cell morphology is to varying degrees suggestive of true pernicious anemia. A varying degree of leucopenia has frequently been noted. However, this may not be present. Examination of the stool is negative as a rule, a few of the cases included in the Indian series¹⁶ showing parasites. Gastric analysis²¹ shows a low acidity or an achlorhydria. The direct van den Bergh is negative.¹⁸ The indirect is positive.¹⁸ The urine¹⁸ as a rule is negative for urobilin.

The course of this anemia is progressive. Often this is gradual but at times the severity of the anemia increases with startling rapidity. According to Peterson,⁹ Reist had a case with extremely rapid blood destruction. This patient was given 1,600 c.c. of blood by transfusion in three days. In spite of this her anemia was found to be worse. Premature labor¹⁶ is frequent and is almost always extremely easy with practically no loss of blood. As has been noted by Balfour,¹⁶ a crisis often occurs from two to three days postpartum. If the patient survives this, recovery may occur spontaneously. In many cases there is a prolonged convalescence.

The diagnosis depends on the clinical symptoms and the blood picture. Care must be taken not to mistake these cases for hyperthyroidism,¹⁴ toxemia of pregnancy,¹⁶ endocarditis,⁶ gastrointestinal conditions, sepsis⁶ or myasthenia gravis.²³

Larrabee⁶ states that he can find only one case of true pernicious anemia complicated with pregnancy which is not open to question. He thinks all others are anemia of the type with which this paper is concerned. Wilkinson¹⁵ states that the association of true pernicious anemia with pregnancy is rare, but that it may become much more frequent now that it is possible to control pernicious anemia with liver therapy.

The prognosis for the mother is greatly changed by modern methods of treatment. All of the cases of patients reported by Channing¹ died, although he states

that he knew of recoveries. Three of the 4 patients seen by Larrabee⁶ before the days of transfusion, died. Schmidt² states that 87 per cent died before transfusion became practical, and Wilkinson¹⁵ says that with transfusion 90 per cent survive. Gupta¹⁶ states that of the untreated Indian patients 25 per cent die in labor and 50 per cent die within a week of delivery, 5 per cent die some weeks later, and 20 per cent show a rapid cure during the puerperium. With treatment McSwinney, Balfour and Mitra show a total maternal mortality of 39.8 per cent. They also state that patients with severe diarrhea offer the worst prognosis. As to the possibility of recurrence in future pregnancies opinion is divided. Many cases have been reported in which recurrences did occur, while other observers state that they have not seen such a recurrence. The main danger to the fetus is prematurity. Infants born at or near term should survive, and they have been found to show a normal blood picture. Straus²² recently reported a transient macrocytic anemia in two babies born of mothers with a macrocytic anemia. He feels that the vitamin B in milk prevents further trouble.

The treatment of these cases depends to some extent on their severity and upon the stage of the disease. The frequency of anemias of the secondary type in pregnancy should make the necessity of routine blood counts seem obvious. The most important time for the performance of blood counts would seem to be when the patient is first seen, at the seventh month, and shortly before term. By doing this many secondary anemias and an occasional primary one would be discovered. If the diagnosis is made early, the anemia can be controlled by large doses of liver extract or ventriculin.^{5, 15, 19} Often intramuscular liver is more effective, particularly in cases with marked gastrointestinal symptoms. The patient can be carried along to a period of viability when occasionally cesarean section may be indicated. Many of these patients show a deficient or absent hydrochloric acid in the gastric juice and should receive dilute hydrochloric acid. The gastrointestinal symptoms, which resist all direct methods of treatment, usually subside under liver therapy. It must be remembered that it takes about ten days for liver to show an effect on the blood count. Therefore, in the more severe cases, and in those which are seen in the late stages of the diseases, transfusion should be used, and used repeatedly if necessary.^{6, 10, 11, 15, 16, 19} This is particularly important if evidence of an aplastic bone marrow is present. A special indication exists at the time of labor because a crisis may occur shortly after this event. This procedure serves to tide the patient over the critical period before liver medication can take effect. The patient should be kept on liver therapy for at least two months postpartum. Finally, some patients seem to do better if iron is used in combination with liver.²¹

REFERENCES

- (1) Channing, W.: *New England Quart. J. M. & S.* 1: 157, 1842.
- (2) Schmidt, H. B.: *Surg. Gynec. Obst.* 27: 596, 1918.
- (3) Osler, Wm.: *Brit. M. J.* 1: 1, 1919.
- (4) Bardy, E.: *These de Paris*, 1924.
- (5) Smith, C. T.: *Surg. Gynec. Obst.* 40: 223, 1925.
- (6) Larrabee, R. C.: *Am. J. M. Sc.* 170: 371, 1925.
- (7) Lyon, E. C.: *J. A. M. A.* 92: 11, 1929.
- (8) Bland, Goldstein, and First: *Am. J. M. Sc.* 179: 48, 1930.
- (9) Peterson, Fried, and Morgan: *J. A. M. A.* 94: 839, 1930.
- (10) Ashburn, C. W.: *South. M. & S.* 93: 893, 1931.
- (11) Moran, T. A.: *J. Iowa M. Soc.* 21: 295, 1931.
- (12) Wills, L.: *Brit. M. J.* 1: 1059, 1931.
- (13) Wills, L., and Billimoria: *Ind. J. Med. Res.* 20: 391, 1932.
- (14) Handlin, L. E.: *J. A. M. A.* 199: 2264, 1932.
- (15) Wilkinson: *J. Obst. & Gynec., Brit. Emp.* 39: 293, 1932.
- (16) Gupta, N.: *Ind. Med. Gazette* 67: 459, 1932.
- (17) Gupta, N.: *Ind. Med. Gazette* 67: 421, 1932.
- (18) Muncaliar and Rao, K. N.: *Ind. J. Med. Res.* 435, 1932.
- (19) Whitby, L. E. H.: *J. Obst. & Gynec., Brit. Emp.* 39: 267, 1932.
- (20) Castle and Straus: *Am. J. M. Sc.* 184: 655, 1932.
- (21) Castle and Straus: *Am. J. M. Sc.* 185: 539, 1933.
- (22) Straus, M. B.: *J. Clin. Invest.* 12: 345, 1933.
- (23) Terfes, L. G., and Greene, J. A.: *J. Lab. & Clin. Med.* 18: 490, 1922.

THE RELATION OF ANEMIA OF PREGNANCY TO HYDREMIA
AND ITS TREATMENT WITH AQUEOUS EQUINE LIVER
EXTRACT AND GLYCERATED IRON

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THE occurrence of anemia in a considerable number of women when pregnant has been recognized for many years. Kerwin and Collins,¹ in their study of 86 patients, found that 15.1 per cent had hemoglobins of 70 per cent or below during the third trimester. More recent reports, however, indicate that anemia during pregnancy is much more prevalent. An incidence of 38 per cent with hemoglobins below 70 per cent during the third trimester was reported by Lyons² in 1929, as compared to 32 per cent in his control series of 100 nonpregnant women. Because of these comparative findings, he suggested the possibility of the presence of a preexisting anemia, which was not necessarily dependent upon pregnancy, per se. However, he found that, in 42 patients studied at the beginning of the third trimester, 47.6 per cent had an average fall of 10.5 per cent in hemoglobin at the end of term, and he believed that in this group therapy was indicated. Similar findings were reported by Galloway.³ In his series of 382 patients, the average hemoglobin estimations for the first, second, and third trimesters, were 73 per cent, 69 per cent, and 66 per cent, respectively, the majority of which returned to normal fairly rapidly after delivery. These observations were further corroborated by the reports of Mussey⁴ and Bland and Goldstein.⁵

Severe anemia complicating pregnancy is extremely rare. During one year of observation in a large prenatal and obstetric service, having from four to five hundred deliveries a month, no case of severe hemolytic or true pernicious anemia of pregnancy was seen. Anemia occurring during pregnancy may result from complications, which in our series were due to such conditions as chronic and acute blood loss, toxemia, puerperal infections, nephritis, malaria, sickle cell anemia, syphilis, pernicious anemia, and leucemia. Of the 3 patients having pernicious anemia, 2 were diagnosed prior to pregnancy, the third entering the hospital during her first blood relapse, which began about the fifth month of gestation. Favorable hematologic responses were obtained in all three instances following the administration of 3 ounces of oral equine liver extract daily (one ounce = 300 gm. of liver). A normal hemo-

globin and erythrocyte level was readily maintained on continued treatment throughout the balance of pregnancy, which terminated uneventfully.

One case of sickle cell anemia was observed in a sixteen-year-old colored primipara, who was admitted to the hospital in labor. Following a comparatively normal delivery, it was noticed that the patient had a marked pallor. The second postpartum day was initiated with a severe chill, followed by a temperature of 103.4° F. There was a decided icteric tint of the mucous membranes. The spleen was enlarged, extending four fingerbreadths below the costal margin. The blood Wassermann was negative. The blood examination on the tenth postpartum day revealed a hemoglobin of 37 per cent (Sahli), an erythrocyte count of 2,170,000, and a leucocyte count of 15,300. The reticulocyte count was 2.6 per cent. Sickling of the red cells was found in the stained films and wet preparations. One ounce of oral equine liver extract was administered three times a day. A maximal reticulocyte response of 17.8 per cent was obtained on the fifth day. At the end of sixteen days of treatment, the patient left the hospital with a hemoglobin of 55 per cent, an erythrocyte count of 3,860,000, leucocyte count of 7,300, and a reticulocyte count of 0.2 per cent, following which she returned to the anemia clinic for further treatment. After five weeks of continued liver therapy, however, no further hematologic or clinical improvement was noted, at the end of which period she failed to return for observation.

Leucemia complicating pregnancy, although extremely rare, was seen in one case in this series. A multipara (para vii) thirty-nine years of age, entered the hospital in labor. The history obtained at this time revealed that she was in good health up to six weeks previously, when she suddenly developed a sore throat, with attacks of vomiting, chills, and fever, which persisted for two weeks. In addition she also stated that she had several severe nosebleeds and noticed a moderate enlargement of the glands in her neck. Following this she was able to be up and about, although she remained extremely weak, until the onset of labor. Several hours after entrance, she delivered premature twins, which was followed by a moderate postpartum hemorrhage. Physical examination revealed a markedly anemic white female. There were scattered petechial hemorrhages in the upper eyelids and in the extensor surfaces of both lower extremities. The anterior and posterior cervical lymph glands were moderately enlarged. There was slight injection of the throat. There was no apparent enlargement of the spleen or liver. The blood examination on the fourth postpartum day revealed a hemoglobin of 30 per cent, erythrocyte count 1,910,000, and white count 134,200, the differential showing many immature white cells, 89 per cent of which were myeloblasts. There were no abnormal findings in the blood examined from both infants. Because of the patient's poor condition, a transfusion was given on the fifth postpartum day. The white count dropped to 7,600 on the fourteenth day, the differential still showing the presence of many immature white cells, 32 per cent of which were myeloblasts. No further response was obtained to repeated blood transfusions, liver extract, or iron therapy. After several months of a stormy course, she finally succumbed, the subleukemic phase remaining up to the time of death.

Since the majority of women when pregnant develop an anemia without any apparent cause, a special study of this group was undertaken. This included an investigation to ascertain, if possible, the etiologic factors responsible for the anemia, the relationship of hydremia

to the anemia of pregnancy, and the therapeutic value in this anemia of a preparation containing aqueous equine whole liver extract, glycerated iron, and hemoglobin. This work was made possible through the courtesy and cooperation of the attending staff of the obstetric and prenatal division of the Cook County Hospital.

PRENATAL DATA AND OBSERVATIONS

Ninety-nine patients registered at the prenatal clinic during the first and second trimester with no obvious or preexisting organic disease. At the first visit to the antenatal clinic, each patient received a thorough physical and obstetric examination, including a routine blood Wassermann, urinalysis, and blood pressure determination. A more complete history was obtained at the anemia clinic, particularly as to their diet, weight changes, previous nursing history (in multiparas), dental condition, metabolic disturbances, and examination was made for possible foci of infection. A blood examination was then made, which included a hemoglobin determination by the Sahli method, calibrated so that 100 per cent was equal to 14.8 gm. of hemoglobin per 100 c.c. of blood, and erythrocyte, leucocyte, and differential count. This latter examination was repeated at from two- to six-week intervals throughout pregnancy. After parturition, one or two blood examinations were made during the ten-day period of hospitalization. Following dismissal, blood examinations were again resumed at from two- to four-week intervals at the anemia clinic.

The average age in this group was 24.3 years. The series included 23 white and 72 colored women, and represented 27 primiparas and 72 multiparas. Careful inquiry into their dietary history revealed that between 70 and 80 per cent lived on a regime deficient in essential foodstuffs. These faulty dietary habits were, in most instances, attributed to poverty or to the restricted food rations received from charity organizations. A résumé of the diets revealed that the majority were inadequate in muscle meats, fresh fruits, and vegetables, and occasionally deficient in fats. The major portion of the diets consisted of liberal or excessive amounts of carbohydrates in the form of bread, potatoes, cereals, and sweets.

The initial blood examination revealed that the majority of the women had an anemia. This was not surprising, considering the prevalence of foci of infection (teeth and tonsils), their poor living and environmental conditions, plus inadequate diets, factors undoubtedly responsible to a certain degree for a preexisting anemia not related to pregnancy, *per se*. Of the 99 patients examined, 51 had a corresponding reduction in both the hemoglobin and erythrocytes, with a color index between 0.9 and 1.0. The red blood cells showed very little morphologic changes other than a slight hypochromasia. Thirty-seven patients had a slightly greater reduction in hemoglobin than the erythrocyte decrease, with an average color index between 0.8 and 0.9, the red cells showing only moderate but distinct hypochromasia. Eleven patients, although having only a moderate reduction in erythrocytes, had a marked reduction in hemoglobin, with an average color index between 0.6 and 0.8. The stained blood films of this group showed a marked pallor of the erythrocytes, and

a moderate anisocytosis and poikilocytosis. It was in this group only that symptoms referable to an anemia were obtained, such as easy fatigability, weakness, palpitation, dyspnea, and pallor.

Since we⁶ have previously shown that an aqueous equine liver extract and glycerated iron in defibrinated blood was beneficial in the treatment of secondary and hypochromic anemias, it was thought that treatment with this preparation in the anemia of pregnancy, might be of some benefit. A careful analysis of one and one-half ounces of this preparation, which was the average daily dose administered to our patients, shows that it contains the extract of 84.4 gm. of whole liver, a total of 104.24 mg. of metallic iron (6.75 mg. from liver, 5.62 mg. from hemoglobin, and 91.87 mg. from the neutral glycerol-iron compound), and a total of 1.4 mg. of metallic copper. In order to obtain some compar-

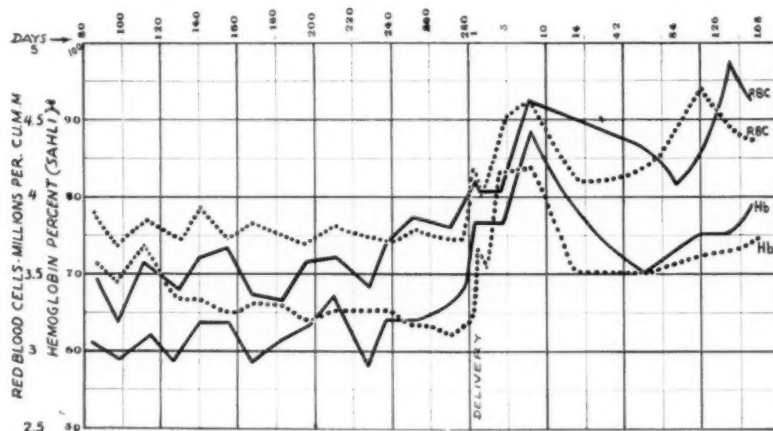


Chart 1.—Representing the changes occurring in the hemoglobin and erythrocyte concentration in normal pregnant women before and after delivery. — Average hemoglobin and red blood count concentration in 38 pregnant women (treated). Average hemoglobin and red blood count concentration in 61 pregnant women (control).

tive studies as to the effectiveness of this preparation, the entire group, on the first visit, was divided into a "treat" and "control" group, each representing the three types of anemias encountered (Table I, Treat and Control Groups). Thirty-eight patients with an average hemoglobin of 58.3 per cent and an erythrocyte count of 3,339,000 per c.c. were started on treatment. The remaining 61 patients with an average hemoglobin of 65.0 per cent and erythrocyte count of 3,384,000 per c.c. remained untreated and were used as controls. The changes occurring in the hemoglobin and red blood cell count before and after delivery, as averaged for the total number of patients studied, are represented in a composite graph (Chart 1).

A progressive reduction in hemoglobin and erythrocytes was noted in the control group with each succeeding month of pregnancy (Chart 1).

The hemoglobin showed a proportionally greater decrease than the erythrocytes, dropping from an average of 71 per cent at the end of the first trimester, to an average of 63 per cent two weeks before term, whereas the erythrocyte concentration during the corresponding period showed only a moderate decrease, from 3.86 to 3.72 millions. The average weight gained per patient during this period was 39 pounds.

TABLE I. HEMOGLOBIN AND ERYTHROCYTE DETERMINATIONS OF 99 NORMAL PREGNANT WOMEN, AT THE FIRST VISIT, TABULATED ACCORDING TO THE PERCENTAGE OF HEMOGLOBIN

NUMBER OF PATIENTS	AVERAGE DURATION OF PREGNANCY (DAYS)	HEMOGLOBIN PER CENT (SAHLI)	AVERAGE R.B.C. IN MILLIONS
<i>Treat Group</i>			
4	100	40-50	3.10
19	127	50-60	3.23
14	111	60-70	3.59
1	84	70-80	3.83
<i>Control Group</i>			
1	105	40-50	3.07
3	91	50-60	3.41
37	107	60-70	3.69
16	111	70-80	4.07
4	102	80-90	4.64

A summary of the blood changes occurring in the group treated with the liver, iron, and hemoglobin preparation, revealed that there was a gradual but progressive increase in hemoglobin and red blood cells. The erythrocyte concentration showed an average rise from 3.46 millions per c.c. to 3.95 millions at the end of term, with a corresponding increase in hemoglobin, which showed an average rise from 61 to 69 per cent. The color index remained about 0.8 throughout treatment. The average weight gain per patient during this interval was 31 pounds.

It was evident from these findings that the administration of the equine liver extract, iron, and hemoglobin preparation not only prevented a gradual reduction in hemoglobin and erythrocyte concentration during normal pregnancy, but produced a reversal of this trend, and in the majority of patients a moderate increase in hemoglobin and red blood cells was obtained. This favorable response indicated that the anemia of pregnancy, at least to a certain degree, was due to a deficiency in the blood-building materials necessary for hematopoiesis. Furthermore, as we have previously stated, the majority of our patients had inadequate diets and a preexisting anemia. Since the fetus obtains its chief blood-building material during the latter months of pregnancy, and the anemia became most marked during the last month, it can be assumed that the anemia, at least in part, resulted from an inadequate supply of the hematopoietic substances necessary to meet both the fetal and maternal requirements.

Inasmuch as a normal hemoglobin and erythrocyte concentration was not entirely obtained in the "treated" group, it was apparent that other factors were responsible for the anemia which still persisted. It has been suggested that the anemia occurring during pregnancy is the result of a toxic hemolysin produced by the placenta or fetus, or by a toxic inhibition of the blood-forming organs. However, no conclusive evidence has been submitted to verify these hypotheses. Recently Strauss and Castle^{7, 8} found from the gastric analysis of 24 patients during pregnancy and the puerperium, that marked reduction in the secretion of hydrochloric acid and pepsin occurred in 75 per cent of their patients during more than half of the period of pregnancy, and that 80 per cent of these women, excluding 3 with persistent achlorhydria, secreted higher concentrations of hydrochloric acid in the gastric juice after delivery. In view of these findings, and the response which they⁹ obtained from the administration of large doses of iron in hypochromic anemias of pregnancy, they concluded that this anemia is due either to direct dietary deficiency, or to a deficiency brought about by defective gastric activity.

BLOOD CHANGES OCCURRING AFTER DELIVERY

The average blood loss during delivery was between 200 and 300 c.c. A spontaneous recovery in the hemoglobin and erythrocytes was noted in both groups immediately after delivery. The "control" group reached a maximal hemoglobin of 83 per cent (Sahli), with an erythrocyte concentration of 4.62 millions on the eighth postpartum day. A maximal hemoglobin of 88.5 per cent (Sahli), and an erythrocyte count of 4.60 millions per c.c. was attained on the eighth postpartum day, in the "treat" group. However, these normal levels were maintained only for a short interval, as further observation showed that a gradual drop in hemoglobin and red blood cell count occurred, reaching a minimum during the sixth postpartum week. Following this recession, there was a gradual rise in the hemoglobin and erythrocyte concentration, the increase in erythrocytes being more marked than that of the hemoglobin, in both groups. However, more rapid regeneration of the hemoglobin was noted in the "treat" group.

RELATIONSHIP OF HYDREMIA TO THE ANEMIA OF PREGNANCY

Since the majority of pregnant women recover spontaneously and rapidly shortly after delivery, it is quite evident that this temporary postpartum gain cannot be entirely due to increased blood regeneration. Evidence has been produced that the anemia during pregnancy, to a certain degree, is physiologic. Keith, Rowntree, and Gerahty¹⁰ found that the volume of blood, particularly the plasma, according to body weight, increased in the latter months of pregnancy. An explanation, therefore,

that the anemia is due largely to an increase in plasma volume, with a relative decrease in cellular concentration, appears logical. Determinations made by Keith, et al.,¹⁰ from seven to ten days after delivery, indicated that the average loss of volume of blood was 1,100 c.e., the largest loss being in the volume of plasma. Since no corresponding decrease occurred in the total corpuscular volume, it is apparent that the relative increase in cellular concentration is largely responsible for the speedy postpartum recovery.

The average weight gain per patient in the "treat" group and the "control" group, including the weight of the fetus, was 31 and 39 pounds, respectively. Since the blood and plasma volume increase with an increase in body weight, a special study of 14 patients was made to ascertain the relationship of the hydremia to the anemia of pregnancy. This special group was composed of 8 treated and 6 untreated patients. The lowest gain in weight was 4 pounds, the average gain 27.3 pounds, and the highest gain 57 pounds, which represented approximately, as a class, the variation of weight changes frequently observed during pregnancy. In addition, blood volume determinations were made in 6 young normal nonpregnant women, which were used as standards.

The method for estimating blood volumes, with two exceptions, was followed precisely as described by Rowntree and Brown.¹¹ Instead of using a solution of 1.5 per cent of vital red or Congo red, we employed a 1.5 per cent solution of brilliant vital red, as used by Whipple.¹² Although each patient had a preliminary rest period, blood volume estimations were done while they were in a sitting posture, instead of the supine position recommended by Rowntree and Brown.¹¹ Ten cubic centimeters of blood were withdrawn before and from four to seven minutes after the injection of the calculated amount of dye. Four samples of 5 c.e. each, were placed in graduated hematocrit tubes, containing 1 c.e. of 1.6 per cent solution of sodium oxalate, and centrifuged for one hour. The standard was then prepared from the plasma without dye, and compared with the unknown by the colorimetric method, and calculations were made for plasma and whole blood volume.

In interpreting the results obtained (Table II) it was found that the mean total blood volume was increased in both groups, prior to delivery, and that the greatest increase was due to the plasma. Although both groups had a preexisting anemia, in part responsible for the moderate relative increase in plasma volume, it was apparent that the anemia occurring during the latter months of pregnancy was partly due to a cellular dilution.

Immediately after delivery there was a noticeable rise in the hemoglobin and erythrocytic concentration of both groups. In view of this rapid postpartum recovery, the actual blood loss during delivery, and the absence of regenerative changes in the blood, it was obvious that this spontaneous recovery was due to other factors than to blood regen-

BLOOD AND WEIGHT CHANGES OCCURRING DURING PREGNANCY BEFORE DELIVERY

PATIENTS		BLOOD AND WEIGHT CHANGES OCCURRING DURING PREGNANCY BEFORE DELIVERY												
		HEMOGLOBIN PER CENT (SAHL)	R.B.C. PER C.C. IN MILLIONS	WEIGHT IN KILOGRAMS	CELLS BY HEMATOCRIT (PER CENT)	TOTAL BLOOD VOLUME IN C.C.	TOTAL PLASMA VOLUME IN C.C.	BLOOD VOLUME IN C.C. FOR EACH KG. OF BODY WEIGHT	CELLULAR VOLUME IN C.C. FOR EACH KG. OF BODY WEIGHT	PLASMA VOLUME IN C.C. FOR EACH KG. OF BODY WEIGHT	DAYS OF SERVA- TION	WEIGHT IN KILOGRAMS (SAHL)	R.B.C. IN MILLIONS	
A	Before Delivery	61.0	3,628	69.0*	36.1	5,988	3,826	86.8	31.3	55.5	137.8	67.2	3.61	3.62
	8-10 Days After Delivery	69.0	4,047	60.0	39.3	4,117	2,499	68.6	27.0	41.6	---	---	---	---
B	Before Delivery	60.5	3,764	72.5*	36.9	6,117	3,860	84.4	31.1	53.3	154.6	56.8	3.19	3.76
	8-10 Days After Delivery	78.0	4,343	63.6	42.0	4,308	2,499	67.7	28.4	39.3	---	---	---	---
C	Nonpregnant	74.7	4,328	63.2	43.0	4,455	2,539	70.5	30.3	40.2	---	---	---	---

*Including fetal weight.

eration. The results obtained from the blood volume determinations from eight to ten days after delivery, revealed that in the control group there was a mean reduction in the total blood volume of 1,871 c.c. of which 1,327 c.c. were in plasma (Table II, A), whereas the treated group (Table II, B) showed a mean reduction of 1,809 c.c. and 1,361 c.c. respectively. A moderate decrease in the cellular volume, estimated in cubic centimeters for each kilogram of body weight, was also noted in both groups. The mean volume of packed cells, however, as determined by the hematocrit method, showed that after delivery there was an increase of 3.2 per cent in the control group, and 5.1 per cent in the treated group. These findings, therefore, indicate that the large loss of plasma was chiefly responsible for the increase in cellular concentration. Hence, it is apparent that the remarkable, but transient, postpartum blood recovery observed in most instances was primarily due to a concentration of the red blood cells by a physiologic reduction of plasma volume.

SUMMARY

In the blood studies of 61 normal pregnant women, it was found that the majority developed an anemia, which became most marked during the latter months of pregnancy. Thirty-eight pregnant women, under the same condition, treated with a preparation consisting of concentrated whole liver, iron in glycerol, and defibrinated blood, showed a gradual but favorable hematologic response. Complete hematologic recovery, however, was not obtained in the majority of patients, during pregnancy, on continued therapy. This indicated that perhaps a combination of various factors was responsible for the anemia, which in our studies could be attributed to a preexisting anemia, poor environmental conditions, inadequate diets with an insufficient blood-building material necessary for both fetal and maternal demand, and hydremia.

The rôle of hydremia in the anemia of pregnancy was studied in 14 cases, including 8 treated and 6 control patients with 6 nonpregnant women as standards. The results obtained from the determination of the total blood and plasma volume before and after delivery indicated that the anemia, in the last month of pregnancy, to a certain degree, was due to a cellular dilution resulting from an increase in the plasma volume, and that the spontaneous postpartum recovery was primarily the result of a cellular concentration produced by a reduction of plasma volume during or shortly after delivery. Five cases of pregnancy complicated by pernicious anemia, sickle-cell anemia, and leucemia are also discussed.

REFERENCES

- (1) *Kerwin, William, and Collins, Lisle*: Am. J. M. Sc. **172**: 548, 1926. (2) *Lyons, Edward C.*: J. A. M. A. **92**: 11, 1929. (3) *Galloway, Charles E.*: J. A. M. A. **93**: 1695, 1929. (4) *Mussey, Robert D.*: Lancet. **52**: 643, 1932. *Mussey, Robert D., Watkins, C. H., and Kilroe, J. C.*: AM. J. OBST. & GYNEC. **24**: 179, 1932. (5) *Bland, P. B., and Goldstein, L.*: Am. J. M. Sc. **179**: 48, 1930. *Bland, P. B., Goldstein, L., and First, A.*: Surg. Gynec. Obst. **50**: 954, 1930. (6) *Richter, Oscar, Meyer, Arthur E., and Legere, Helen*: J. Lab. & Clin. Med. **17**: 1185, 1932. (7) *Strauss, M. B., and Castle, W. B.*: Am. J. M. Sc. **184**: 663, 1932. (8) *Strauss, M. B., and Castle, W. B.*: Am. J. M. Sc. **184**: 655, 1932. (9) *Strauss, M. B., and Castle, W. B.*: J. Am. M. Sc. **185**: 539, 1933. (10) *Keith, N. M., Rowntree, L. G., and Gerahty, J. T.*: Arch. Int. Med. **16**: 547, 1915. (11) *Rowntree, L. G., and Brown, G. E.*: The Volume of the Blood and Plasma in Health and Disease, Mayo Clinic Monographs, W. B. Saunders Co., 1929. (12) *Hoooper, C. W., Smith, H. P., Belt, A. E., and Whipple, G. H.*: Am. J. Physiol. **50**: 205, 1920.

A STUDY OF 79 PATIENTS DELIVERED BY THE LATZKO EXTRAPERITONEAL CESAREAN SECTION*

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A PAPER written by me on the Latzko cesarean section was published in the June, 1930, issue of the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, to which I would refer for a more complete outline of the history, indications, advantages, and disadvantages; as well as a detailed description of the technic of the operation.

I believe that the Latzko cesarean section may be used with advantage in the following types of cases:

1. Infected or potentially infected cases in which a favorable outcome for either mother or baby seems hazardous by the vaginal route, or intraperitoneal cesarean section.
2. Cervical dystocia with little or no progress following prolonged labor with numerous vaginal examinations.
3. Contracted pelvis, where an attempt at delivery with forceps has failed.
4. Very prolonged trial labors in which vaginal delivery is found impossible, whether deemed clean or potentially infected.

From the days when cesarean sections were first done, all efforts to improve the technic have had two objectives: first, to eliminate hemorrhage, and second, to prevent peritonitis.

The operation is not suitable unless the patient has been in labor long enough to have a thinned-out and well-retracted lower uterine segment.

The technic of the Latzko cesarean section has been greatly improved. A mushroom catheter is placed in the bladder and the bladder is distended with about 250

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c.c. of sterile water. A moderate *Trendelenburg* position is used. A suprapubic midline incision extending down to the pubic bone is made. The sheath of the left rectus muscle is opened near the midline and the muscle displaced to the left. The bladder is separated from the posterior sheath of the left rectus muscle at the lower angle of the incision by blunt dissection. The prevesical fascia is easily broken through and perivesical fat comes into view. This line of cleavage is followed down the left side of the bladder until a line of separation is secured between the bladder and lower uterine segment, then back to the anterior surface. The prevesical fascia is separated from the bladder and incised up to the peritoneal reflection. While separating the bladder from the lower uterine segment, and, if necessary, pushing the peritoneal reflection up on the uterus, it is well to release the clamp on the catheter and let most of the water escape from the bladder. A midline incision is made in the lower uterine segment, with care, as it is very thin. I no longer use Allis clamps on the scalp to rotate the head, as it is much easier to insinuate the hand into the lower angle of the uterine incision until the occiput rests in the palm of the hand. The head is lifted above the brim and easily rotated to the anterior position and held firmly while forceps are applied, if necessary. The application and delivery with forceps should be slow and deliberate. Where there has been prolonged, firm pressure against the bladder, or any possible injury during dissection, even though the bladder seems intact, an indwelling catheter should be left in from six to eight days. All cases should be drained.

An analytic study of 79 patients delivered by the Latzko cesarean section is presented herewith.

TABLE I. PREOPERATIVE CONDITIONS

TOTAL CASES		79	PRIVATE 30—WARD 49
Para	{ Primipara	60	Average 14 days
	{ Multipara	19	
Gestation	{ Premature	3	Average 11 days
	{ At term	52	
	{ Past due	24	
Presentation	{ Vertex	70	
	{ Breech	9	
Pelvis	{ Ample	15	
	{ Contracted	64	
Cervical dystocia		20	
Membranes	{ Intact	12	For average of 24 hours
	{ Not stated	7	
	{ Ruptured	60	
Examinations	{ Vaginal	4	5 not stated
Average number	{ Rectal	1.2	7 not stated
Hours in labor, average		30½	
Patients bagged		6	
Attempt at forceps		10	
Contraction rings		6	
Patients with temp. 100° plus		18	
Patients with pulse 120 plus		13	

While Table I gives an idea of the preoperative condition of these patients, one would have to study the individual charts to see what a desperate condition many of these mothers were in before delivery. In a total of 79 cases, 30 or 37.8 per cent, were private, and 49 were public ward cases. This may surprise some who believe the Latzko will never be popular because it is seldom indicated in private practice.

Of the 79 cases presented, 39 of the patients were operated upon by the author, working in 12 different hospitals, with no maternal deaths (Table II). Forty patients were operated upon at the New York Nursery and Childs' Hospital and at Bellevue by 13 obstetric surgeons, with two maternal deaths. The average operating time, when stated, was fifty minutes.

TABLE II. OPERATIVE DATA

Total cases	79
Hospitals	12
Number of operating surgeons	14
Operating time, average 50 minutes	
Peritoneum opened and repaired	15 or 19.5%
Bladder opened and repaired	6 or 7.5%
Bladder healed on discharge	6
Healed primary reunion	5
Vesicovaginal abdominal fistula	1 On tenth day P.O.
Healed spontaneously with indwelling catheter	
Twins	1 set (1st 8 pounds) (2nd 6 pounds)
Anesthesia { Gas and ether	77
{ Spinal	2
Excessive hemorrhage	0

There is little to discuss in regard to most of the complications listed in Table III. Most of the patients with infected wounds also had very foul lochia and uterine infection.

TABLE III. POSTOPERATIVE COMPLICATIONS

TOTAL CASES	79	NUMBER COMPLICATED	39
1. Infected wound		19	
2. Parametritis		4	
3. Phlebitis		3	
4. Paroxysmal tachycardia		2	
5. Bronchitis		2	
6. Pyelitis		2	
7. Postoperative hernia		1	
8. Pelvic cellulitis		4	
9. Salpingitis		1—Exploratory laparotomy on 52nd day	
10. Pulmonary infaret		1	
11. Pulmonary embolus, pneumonia		1	
12. Bacteremia		1	
13. Peritonitis		1	
14. Vesicovaginal fistula		4—Healed spontaneously, 3 Repaired with good results, 1	
15. Gangrene of uterus and bladder		1	

The postoperative hernia followed an infected wound that broke down. This was repaired with good results at a subsequent cesarean section.

The cases of pulmonary embolus, pneumonia, peritonitis, and gangrene are discussed under mortality.

Bacteremia was proved in only one case in which the blood culture was positive for *Streptococcus hemolyticus*. Repeated blood transfusions were given and patient was discharged on the sixty-sixth day.

Three vesicovaginal fistulas occurred in cases where there was not an apparent injury to the bladder at time of operation. The first patient voided normally until the fifth day. The fistula healed spontaneously with indwelling catheter for ten days. The second patient voided normally until the ninth day when a vesico-abdominal fistula and vesicovaginal fistula occurred. In this case the vesicovaginal fistula did not heal with indwelling catheter, but was repaired later with good results. The third patient was septic with a bilateral phlebitis. A vesicovaginal fistula occurred on the twenty-fifth day postoperative. This patient had an indwelling catheter for eighteen days and healed spontaneously. We believe that these fistulas were caused by prolonged pressure on the bladder by the baby's head, or interference of circulation at the time of the operation. The fourth vesicovaginal fistula followed injury and repair to the bladder at the time of operation. This case healed spontaneously with an indwelling catheter.

Maternal morbidity was present in 41 cases or 52.6 per cent (Table IV). This included all patients having a temperature of 100° F. or more for any two days, not counting the first postoperative day.

TABLE IV. MORBIDITY AND MORTALITY

Maternal morbidity	41 or 52.6%
Maternal mortality	2 or 2.52%
Fetal mortality	11 or 13.8%
Total cases	80 (1 set of twins)
Stillbirths	4 <ol style="list-style-type: none"> 1. Cord twice about neck. Autopsy, asphyxia 2. After attempted axis traction forceps, no autopsy 3. Mother septic, no autopsy 4. Mother septic, no autopsy
Neonatal deaths	7 <ol style="list-style-type: none"> 1. $\frac{1}{4}$ hour. No autopsy 2. $\frac{1}{2}$ hour. Autopsy negative 3. $\frac{3}{4}$ hour. Axis-traction forceps attempted. Autopsy, cerebral hemorrhage. 4. 2 hours. Axis-traction forceps attempted. Autopsy, cerebral hemorrhage 5. 12 hours. Autopsy, asphyxia and atelectasis 6. 19 hours. Autopsy, asphyxia and atelectasis 7. 3 weeks. Forceps, cerebral hemorrhage, infected, autopsy

There were two maternal deaths in 79 cases, giving a death rate of 2.52 per cent. A short summary of these cases follows:

CASE 1.—M. O., gravida i, aged twenty-three, at term. After four and one-half hours in labor private doctor ruptured membranes and attempted delivery in tement house with forceps, with three fingers' dilatation. Later admitted to Bellevue Hospital with tonic uterus; cervix three fingers dilated; blood pressure 160/100; pulse 140; temperature 104.2°; respiration 32; chills. Latzko cesarean section. No injury to bladder or peritoneum. Baby stillborn. Patient died fourth postoperative day. Autopsy showed gangrene of uterus, bladder, and abdominal wound, fibropurulent peritonitis, acute septic splenitis.

CASE 2.—C. W., gravida i, aged twenty-three, at term. Ample pelvis. Had uterine contractions with ruptured membranes for two days at home before admission to Bellevue Hospital. Contractions continued for two more days after admission, with little sleep or rest from morphine and other sedatives. At time of operation the

head was engaged, cervix three fingers dilated, thick and friable. Patient dehydrated. Blood pressure 110/70; pulse 144; temperature 100°; respiration 20. A clysis of 1,000 c.c., and 500 c.c. of 5 per cent glucose given intravenously before operation. Operation lasted one hour and fifteen minutes. Peritoneum and bladder not opened. Ten-and-three-fourths-pound baby stillborn. Patient's condition only fair first post-operative day. Second day had pain in chest, difficulty breathing, marked cyanosis and extreme shock. Blood transfusion and oxygen given. Died on third postoperative day. Diagnosis: pulmonary embolus, pneumonia, and sepsis. No autopsy. While the blood culture was negative, this case followed two other septic maternal deaths on the ward.

The fetal mortality is explained in Table IV, except the two patients that died of asphyxia and atelectasis. In these cases the mothers ceased breathing on induction of anesthesia and were resuscitated with difficulty. One patient had spinal anesthesia and one ether.

CONCLUSIONS

The Latzko operation as described by him twenty-six years ago is still the best type of true extraperitoneal cesarean section in use today. Familiarity with the technic of this operation will save the obstetrician much anxiety in cases of prolonged labor. He realizes that with the Latzko at his command he may still perform a cesarean section with safety after repeated examinations, bagging, or attempt at forceps. A thinned-out and well-retracted lower uterine segment is most advisable. If the technic, as outlined, is employed, there will be little danger of injury to the peritoneum or bladder. I feel that this operation, more than any other type, eliminates hemorrhage and prevents peritonitis. A study of 79 cases delivered by this method shows a low mortality for mothers and babies, considering the types of cases selected for this operation.

667 MADISON AVENUE

DISCUSSION

JOHN A. MCGLINN.—Latzko's operation is very beautiful and apparently simple yet, shortly after it was first proposed, makeshift operations were devised to accomplish what the Latzko did and yet get rid of the apparent difficulty and risk attached. The operation, by Dr. Hirst, opened the peritoneal cavity and attached the peritoneum of the uterus to the parietal peritoneum, therefore creating a peritoneal fistula in which the drainage from the uterus was discharged through the fistula without contaminating the peritoneal cavity. In many cases, however, this failed as the peritoneal attachments were torn apart. Then came the operation which we all do at the present time, the one which Beck proposed.

DR. B. C. HIRST.—I have always been interested in extraperitoneal cesarean section, and have tried several varieties but I must confess to a prejudice against the Latzko operation. Having seen Latzko operate I was not much impressed with his technic and on entering practice the era of laparoclytrotomy in New York with its mortality 50 per cent, was recent enough to leave a strong sentiment against it in our minds. From the clear description by Dr. Burns it is evident that we must

think more seriously of this form of cesarean section. In regard to the extra-peritoneal operation that I devised simultaneously with, but independent of Veit and Fromme, the main objection to it, tearing the peritoneal flaps, can be avoided by the use of T-shaped hemostats while delivering the fetus. There are better plans, however, of accomplishing the same result.

In the worst forms of infection before delivery, I prefer the modified Porro operation: Ligating the broad ligaments, incising them to the cervix, cutting the cervix across with a cautery knife; and sewing the parietal peritoneum around the stump which is allowed to fall back as far as it will, leaving a small sinus to be drained with gauze. For moderate, presumed infections, I think the Beck or Munro-Kerr operation should suffice.

DR. H. T. BURNS (closing).—Drs. Davis and Thomas, in performing the extra-peritoneal cesarean section known as gastroelytrotomy, made an incision over Poupart's ligament and separated the layers of the broad ligament, encountering a large number of blood vessels. In the Latzko cesarean section we try to stay as near the midline as possible, at all times.

I would advise against the Latzko cesarean in patients with marked varicose veins of the legs and vulva; also in cases of placenta previa.

AN ANALYSIS OF 157 CASES OF CESAREAN SECTION

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THE object of this analysis is to attempt to record the details of the cesarean sections performed in Akron's hospitals during the three-and-one-half-year period from January, 1930 to July, 1933. The three hospitals cooperating in the survey were as follows: City, Peoples, and St. Thomas. For comparative purposes, an effort is made to follow the outlines of similar analyses from other cities.

The use of cesarean section as a method of delivery can be likened to the vogue or style of men's and women's clothes. By this I mean that since its introduction its use was greatly popularized for a time, only to be discarded and again repopularized. The operation has been greatly abused as is evidenced by the large percentage of cases of cesarean section in certain communities, as high as 9 or 10 per cent. The high morbidity and mortality associated with its use indicates that there has not been adequate consideration of the indications, and in some cases a total disregard of the contraindications.

INCIDENCE OF OPERATION AND MORTALITY

As Table I indicates, in the three-and-one-half-year period 6,533 women were delivered in the three hospitals, with 157 cesarean sections, an incidence of one in 41 hospital deliveries.

Seven women died following operation, an incidence of one death in 22 operations or a mortality rate of 4.5 per cent.

TABLE I. INCIDENCE OF OPERATION AND MORTALITY

HOSPITAL	TOTAL DELIV.	CESAREAN SECTIONS	INCIDENCE OPERATION	DEATHS	PER CENT MORTALITY
A	1786	72	1 to 25	2	2.7
B	3204	58	1 to 55	4	6.9
C	1543	27	1 to 57	1	3.7
Total	6533	157	1 to 41	7	4.5

The incidence of operation varied from one in 25 to one in 57 hospital deliveries. The mortality rate varied from 2.7 to 6.9 per cent. The 157 operations were performed by 40 operators, only three of whom did more than 12 operations each. The greatest number of operations performed by any one operator was 36.

TABLE II. TYPES OF OPERATION. DETAILS OF DIFFERENT TYPES OF OPERATION

TYPE	NO.	INCIDENCE	PER CENT	DEATHS	INCIDENCE OF DEATH	PER CENT MORTALITY
Classical	127	1 to 1.2	80.8	6	1 to 21	4.7
Low cervical	15	1 to 10	9.5	1	1 to 15	6.6
Low cervical incision	10	1 to 15	6.3	0	0	0
Porro	4	1 to 39	2.5	0	0	0
Vaginal	1	1 to 157	0.7	0	0	0
Total	157	1 to 41	2.4	7	1 to 22	4.5

The classical section was done in 127 cases. The low cervical section in 15 cases, the modification of the classical with a low cervical incision in 10 cases, the Porro in 4 cases, and the vaginal in one case. Six of the 7 deaths followed the classical operation and one followed the low cervical operation.

GENERAL CONSIDERATIONS

Only 9 patients were considered over term by the attending physician. The age of the patients varied from seventeen to forty-seven. Primigravidas made up 54.8 per cent of the series.

INDICATIONS

The indications for the 157 operations are recorded in Table III. An effort was made to group them under the outstanding indication, where multiple indications were found.

These statistics show that contracted pelvis still remains by far the most common indication. There was no maternal mortality in this group. Only 31 of the 54 cases had any pelvic measurements listed on the charts.

Under the heading "dystocia" are included all patients who the attendant decided would be unable to deliver through the pelvis. The

term "failure to progress" would be more appropriate, including both dystocia and inertia, because very few charts gave the cause of dystocia, or differentiated primary and secondary inertia. Three women died in this group as the result of the operation.

TABLE III. INDICATIONS

INDICATION	NO.	PER CENT	INDICATION	NO.	PER CENT
Contracted pelvis	54	34.4	Torsion ovary with gangrene	1	0.6
Dystocia	28	17.9	Traumatic umbil. hernia	1	0.6
Placenta previa	14	8.9	Impacted trans. presentation	1	0.6
Preeclampsia	11	7.0	Tetanic cont. uterus (anencephalic monster)	1	0.6
Eclampsia	10	6.3	Obstructing dermoid	1	0.6
Unyielding cervix	9	5.7	Ruptured uterus	1	0.6
Heart disease	4	2.5	Deformed pelvis (prev. fracture)	1	0.6
Prev. cesarean (cont. pelvis)	2	1.2	Prolapsed and rigid cervix	1	0.6
Prev. cesarean (eclampsia)	2	1.2	Prolapsed arm (incomplete cer. dil.)	1	0.6
Elderly primipara	2	1.2	Double vagina, cervix, bicornate uterus, fibroids	1	0.6
Fibroid obstructing labor	2	1.2	Bicornate uterus	1	0.6
Abruptio placentae	2	1.2	Bullet wound abdomen	1	0.6
Prev. cesarean (indic. ?)	1	0.6	Male type pelvis	1	0.6
Elective (2 prev. stillborn)	1	0.6	Premature labor (prolonged)	1	0.6
Bil. T. B. C. with cavitation	1	0.6			

As the table indicates, of the 157 cases of cesarean section done, 21 or 13.3 per cent were done for threatened eclampsia or eclampsia. These figures are much too high and I believe a far better and more conservative treatment of this condition is that proposed by Arnold and Fay.

ADDITIONAL OPERATIONS

Sterilization was performed in 29 instances or 18 per cent of the series. Appendectomy was performed in 6 cases. Other operations include, excision of fibroids, salpingectomies, oophorectomies, and repair of hernias. In one of the 7 cases of maternal mortality a prophylactic appendectomy was done. I feel that a patient should not be subjected to additional surgery at the time of cesarean section, unless it is directly associated with her well-being at that time.

MATERNAL MORTALITY

The important findings on the charts of women dying following cesarean sections are recorded in Table IV.

At least 3 of the patients had vaginal examinations done before operation. Unfortunately the charts in the first two cases were not complete and no mention was made of the number of vaginal examinations. The last patient was in labor for three days at home before entering the hospital. No mention was made of the number of vaginal examinations made in the home.

TABLE IV. MATERNAL MORTALITY

INDICATION	T.	P.	MEM- BRANES	VAG. EXAM.	HOURS LABOR	ADDIT. OPER.	OPER. TIME	CAUSE DEATH	DAY DEATH
Overdue preg- nancy	N	N	Intact	?	In labor	Appen- dectomy	51	Peritonitis	5
Threatened eclampsia	N	110	?	?	Not in labor	None	55	Postop. gastric dil.	5
Scar tissue (old cervical tear)	N	N	Intact	0	0	Steril.	65	Peritonitis	3
Uterine inertia	N	N	3 hr.	1	6	Steril.	55	Myocarditis nephritis	2
Uterine inertia (twin preg- nancy)	N	N	Intact	0	12	None	44	Paralytic ileus	6
Placenta previa	N	N	Intact	1	10	None	60	Septicemia prev. phlebitis	4
Ruptured uterus	39.8	168	Intact	1	4 days	None	42	Exhaustion	1

FETAL MORTALITY

Table V shows the details of the fetal deaths. Of the 161 babies delivered, including four sets of twins, there were 16 stillbirths and neonatal deaths, a fetal mortality of 9.9 per cent.

TABLE V.—FETAL MORTALITY

DEATHS ACCORDING TO INDICATION		CAUSE OF FETAL DEATHS	
	NO.		PER CENT
Eclampsia	5	Prematurity	5 31.2
Placenta previa	3	Cause not stated	4 25.0
Abruptio placentae	2	* Diagnosed as dead before	
Contracted pelvis	1	operation	3 18.7
Overdue pregnancy (dystocia)	1	Abruptio placentae	2 12.5
Ruptured uterus	1	Ruptured uterus	1 6.2
Fibroid obstruct. labor	1	Anencephalic monster	1 6.2
Premature labor (prolonged)	1		
Tetanic cont. uterus (anencephalic monster)	1		

There were three known dead babies delivered by section, not including the two cases of abruptio placentae or the case of ruptured uterus. The fetal mortality in eclampsia was 31 per cent, in placenta previa 18 per cent.

ANESTHESIA

Nitrous oxide and ether was used in 55 cases, drop ether in 32, ethyl chloride and ether in 28, ethylene in 18, spinal in 17, ethylene and ether in 5, avertin and ether in 2, and local in one case. It was observed that when an inhalation anesthetic was administered longer than ten minutes before the operation was started, some effort to resuscitate the baby was necessary. In 4 of the maternal deaths, the

anesthetic used was nitrous oxide and ether, in one drop ether, in one ethyl chloride and ether, and in one spinal.

I feel that a word of warning should be sounded regarding the use of spinal anesthesia in cesarean sections. Meyer Sabel of Mt. Sinai Hospital in Philadelphia has done considerable work along this line. He lists large abdominal tumors or large quantities of fluid in the peritoneal cavity as direct contraindications to the use of spinal anesthesia. His reasoning is that large abdominal tumors or large amounts of fluid in the peritoneal cavity produce pressure against the diaphragm when the patient is put in the Trendelenburg position. This interferes with cardiac and respiratory functions. The anesthetic itself partially paralyzes the diaphragm and the intraabdominal pressure aggravates the condition.

The author wishes to express his appreciation to the operators and superintendents of the three hospitals for the privilege of reviewing and reporting this material, and for their aid in making this study possible.

106 SOUTH MAIN STREET

PREGNANCY COMPLICATED BY FIBROIDS*

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THE most common tumor of the uterus, leiomyoma (commonly referred to as a fibroid) presents an obstetric problem in fertility, pregnancy, labor, and the puerperium. Because of the possible complications arising in this condition and the lack of uniformity in handling them, it is with some trepidation that the question is approached.

Kosmak¹ has said, "I am frank to confess that the presence of a fibroid tumor associated with pregnancy fills me with doubt and uncertainty until a period of at least three or four months has elapsed since delivery." One cannot grasp the significance of this quotation until chance has dealt him a number of patients of this type.

In order to obtain first-hand information as to the course of pregnancies associated with fibromyomas of the uterus, a study of such cases for the years 1922 to 1933 (inclusive) was made from the files of the Elizabeth Steel Magee and St. Margaret Memorial Hospitals. By this, it was hoped that a summary of the more significant features of this series might facilitate early diagnosis and treatment of similar conditions. No detailed critical analysis has been attempted and statistics have been reduced to a minimum for the sake of brevity and clarity.

*Read before the Pittsburgh Academy of Medicine, February 27, 1934.

The etiology of uterine fibroids is undetermined. We do know they develop only during the reproductive era and that women in whom such tumors develop are less fertile than those bearing a more normal uterus. Many cases appear to be concomitant with ovarian or other endocrine dyscrasias, and there is accumulating evidence^{2, 3} to show that such neoplasms are related to hyperplastic endometritis attributable to hyper-estrogen stimulation from the ovary. That women giving birth to children in early life are less likely to develop fibroids than their nulliparous sisters may still be questioned.

Lipiodol injection of barren uteri frequently outlines nonpalpable tumors and pregnancy may occur after their surgical removal. Kelly and Cullen⁴ have estimated that 50 per cent of sterility is due to fibroids. Graves⁵ states that sterility is twice as frequent in fibroid patients as in the tumor-free. In the following study 27 per cent of the patients had a relative sterility of from two to seventeen years and in this group dysmenorrhea and menorrhagia were commonly found.

During the eleven years covered by this review and from a total of 23,541 deliveries, 71 cases of combined pregnancy and fibromyomas have been obtained, an incidence of 0.3 per cent. Other writers have estimated the proportion as follows:

Craigin and Ryder	0.45 per cent	20,000 cases
Pierson	0.8 per cent	30,000 cases
Watson	1.3 per cent	

Diagnosis of this complication is not always easy. Many of the tumors were undetected until pregnancy was well advanced. This is due to the constant growth of the tumor together with the gradual thinning and softening of the surrounding myometrium. However, rapid growth of a previously detected fibroid is indicative of a combined pregnancy.

The average age of the patients studied was thirty-three years, the extremes being nineteen and forty-three years. Forty-six per cent of these patients were primigravidas; this immediately placed many in that much discussed and worrisome category of "elderly primiparas."

Few of the patients were aware of any abnormality save in the cases of several large tumors. As already noted, some had undergone a period of sterility and this class suffered more from menstrual disturbances. Other symptoms of pain, pressure, and varicosities could not be attributed to the tumors alone. In a few instances slight periodic bleeding occurred which had been mistaken for menstrual bleeding.

Bleeding, abortion, placenta previa and placenta accreta are reputed to be more common in those patients with submucous tumors. Pain, necrosis of the tumor, torsion of the uterus, malpresentation, and dystocia may accompany the intramural form. Relatively few complications are attributed to the subserous or pedunculated type.

Abortion is common owing to defective implantation of the fertilized ovum in an atrophic or edematous endometrium and encroachment upon the uterine cavity by the growing tumor, forced from its bed by muscular contractions. Nine patients, 12.6 per cent, of this series, aborted. In all but three, this occurred before the third month of pregnancy. One-half of this series had from one to three previous abortions. Four other pregnancies, 5.9 per cent, were ended by extirpation of the uterus and the product of conception. Unquestionably the incidence of abortion must be higher because of the many early terminations of pregnancy being completed outside of the hospital. Convalescence is protracted because of lochia retained within the tortuous uterine cavity. The use of the curette and intrauterine packing in such cases I believe is hazardous in view of the unpreventable trauma to uterus and tumor and the greatly enhanced likelihood of infection as shown by the following case:

Mrs. M. (134-283), gravida iii, four months pregnant, was admitted for pains and profuse bleeding. Under ether anesthesia, fetus and secundines were removed from the partly dilated cervix with ovum forceps, and a fibroid the size of a small orange was felt on the posterior wall of the uterus. The uterus was packed with bismuth subiodide gauze. The following day the intrauterine pack was removed without bleeding. She was discharged fifteen days after admission, temperature normal and uterus poorly involuted. One week later, abdominal cramps recurred associated with high fever, chills and several gelatinous fragments of tissue expelled from the vagina. Vaginal examination revealed a large necrotic fibroid presenting at the external os. Symptoms relieved after readmission to the hospital and digital removal of the sloughing tumor.

Myomectomy, during pregnancy, in spite of reports of successful operations should be reserved, I believe, for those cases with a history of past abortions and should be performed if possible after the third or fourth month when the placenta is well formed and securely attached. Of three myomectomies performed during pregnancy, all were followed by abortion; these operations are not totally without hazard. The desperate illness which may follow an untimely myomectomy is evidenced by the case of:

Mrs. F. (129-101), aged thirty-nine years. Examined early in her first pregnancy. Diagnosis: fibromyomas of the uterus and early pregnancy. Myomectomy was performed by the patient's surgeon against advice following a gynecologic consultation, and several subserous tumors removed. A large tumor subserous in type was not disturbed. Two weeks later a fetus was expelled. Four days from this time dilatation and exploration was performed because of retained placental tissue and bleeding. This was followed by gradual elevation of temperature, chills, anemia and prostration with symptoms of severe pelvic peritonitis and inflammation of right parotid and submaxillary glands. Noninterference was again advised and the patient was supported with frequent transfusions and venoclyses of dextrose and saline solution. Eight weeks from the time of the myomectomy a large necrotic fibroid was expelled. Improvement was immediate and rapid.

The danger of later uterine rupture through the myomectomy scar offers an academic objection to operation, but in view of the many patients safely delivered after myomectomy the number of such accidents must be small. In surveying a small series of thirteen cases of ruptured uterus from various causes, but one case can be attributed to rupture through a myomectomy scar. Seventy per cent were due to forceful delivery by vagina and rupture through a cesarean scar was frequent.

COURSE OF PREGNANCY

In 67.5 per cent of the patients studied, pregnancy continued to term. Fourteen per cent were delivered from four to eight weeks prematurely. Death of the fetus may occur at any time because of faulty nutrition or asphyxia due to compression of the placenta by an underlying tumor. This was noted on three occasions, the only stillborn infants of the series, all being premature.

Several pregnancies were complicated by painful and tender tumors and severe secondary anemia, undoubtedly instances of necrobiosis during pregnancy and potential sources of danger during the labor and puerperium. There were no other symptoms more serious than pelvic pressure, backache, cramps, and varicosities of vulva or extremities. In spite of the reputed tendency to premature accidental separation of the placenta, it was not observed in this series.

LABOR

Labor may be seriously complicated by obstructing tumors. However, some of these tumors blocking the inlet may be drawn out of the pelvis with the retracting lower uterine segment, affording engagement of the presenting part. Surgical induction of labor is not to be considered. Vaginal examinations should not be done or should be made with the greatest aseptic care. If delivery by vagina be the method of choice, trauma and intrauterine manipulation should be avoided.

DELIVERY

Of the 59 patients whose pregnancy continued beyond seven months, delivery was accomplished as shown in Table I.

On superficial examination, the 56 per cent incidence of cesarean section appears high, but more critical study reveals that 66 per cent of these radical operations were not done for fibroids per se, but were performed after trial labor, for disproportion, previous cesarean sections or stillborn babies, placenta previa, and cardiac or thyroid disease.

Two maternal deaths were recorded after radical operation: One of streptococcus peritonitis following cesarean section on a patient with

a generally contracted pelvis who had undergone a previous section, another following cesarean section on a patient with recurrent carcinoma of the breast and metastases to the liver.

TABLE I

	CASES	PER CENT
Spontaneous	15	25.7
Forceps	8	13.5
Breech extraction	1	1.6
Internal podalic version and extraction	2	3.2
Cesarean section and myomectomy	30	
Cesarean section and hysterectomy	3	56.0
	59	100.0
Gross operative rate		74.3
Abdominal delivery incidence		56.0

Vaginal operations, particularly internal podalic version and extraction, afforded the highest morbidity and longest convalescence as shown in Table II.

Manual removal of the placenta or placenta accreta did not complicate the third stage of any labor terminated by vagina. Postpartum hemorrhage was common and intrauterine packing, however hazardous, may have to be used in such an emergency.

Peterson⁶ has reported early degenerative changes in most fetuses delivered from women with fibroids. This I cannot substantiate with this relatively small series. Of all babies born alive the average weight was 7.3 pounds (slightly above average weight given by Williams⁷ for male infants). Congenital deformity or monstrosity was not found. One infant died before discharge from the hospital and this was attributed to septic infection of the newborn.

From my own experience, the puerperium is fraught with most serious and trying complications. Nor can one foresee at this time whether the tumor masses are destined to involute rapidly or to degenerate and cause severe and protracted toxic symptoms as in the following case:

Mrs. E. W. (11031), primipara, aged thirty-three. Seven months pregnant. Labor continued for five days. Cord prolapsed for twenty-four hours. Midforceps delivery attempted unsuccessfully. By internal podalic version and extraction a macerated seven months' fetus was delivered. Following delivery patient had an elevation of temperature of from 100 to 103°, chills, and secondary anemia. Supported with transfusions. Sedimentation time eight minutes. Fifty-two days after delivery a supravaginal hysterectomy was done because of a large fibroid on the anterior wall of the uterus. Pathologic examination revealed a large greenish necrotic mass on the anterior surface of uterus smelling strongly of *Bacillus coli* or *pyocyaneus*. In the center of the mass was a cavity containing about 50 c.c. of purulent exudate. Patient was discharged well, sixteen days after the hysterectomy.

Sampson,⁸ whose work on the vascularity of fibroids is preeminent, has demonstrated the following striking features of fibroids of the uterus:

1. Multiplicity of tumors. In 100 uteri injected, 1,108 tumors were demonstrated; only 4 uteri showed a solitary tumor.
2. Fibroids generally have but one nutrient artery but there may be collateral anastomoses, and the venous supply is considerably poorer than that of the surrounding myometrium.

The rhythmic contractions of the uterus in the puerperium tend to evolve the tumor in the direction of the least resistance, thus freeing the mass from its bed and interrupting or constricting its arterial and venous channels. This leads to red degeneration, necrosis, or liquefaction of the tumor substance. Generally this is an aseptic process. However, infection may have been introduced by manipulation or by means of an ascending thrombophlebitis demonstrable in serial sections.

Of the tumors removed at operation in the 29 patients having myomectomy with cesarean section, 20 or 69 per cent were found to contain red degeneration, necrosis, or liquefaction. Campbell⁹ has recently reported degenerative changes in 75 per cent of leiomyomas removed from gravid uteri in contradistinction to 7.8 per cent from nonpregnant uteri.

In a simultaneous study of fibroids from 757 nongravid uteri, 45 per cent contained demonstrable foci of degeneration, all of which would be potential sites of septic or aseptic absorption following such a trauma as that of labor and delivery.

Absorption from such a degenerating tumor is likely to produce a picture of severe infection beginning one or two weeks after delivery. This may be introduced with a chill, high fever, abdominal pain and tenderness, scant lochia, and cachexia. A few grayish gelatin-like fragments of tumor may be found in the lochia. These symptoms may continue at length with prostration and anemia until the tumor has sloughed free from its attachments or has been extruded through the cervix, permitting manual removal, which is a fortunate outcome not always to be expected.

Morbidity and mortality following the various types of delivery are shown in Table II.

TABLE II

	MATERNAL DEATHS	FETAL DEATHS	MORBIDITY	HOSPITAL DAYS
Spontaneous	0	1	17.5%	14.5
Radical Operation	2*	1†	26.0%	19.0
Vaginal Operation	0	1	54.5%	26.3

*One peritonitis (streptococcal), 1 metastatic carcinoma of liver.

†Intrauterine death.

Subinvolution of fibroids after parturition was common when the fibroids were left in situ. Watson¹⁰ states that in his experience this was usual, although it is generally thought that they atrophy. Many of the patients, who prior to pregnancy had been symptomless, were operated upon months later because of pelvic distress and large fibroids were removed; pregnancy acts, therefore, as a permanent stimulus to the growth of fibroids.

SUMMARY

1. A series of 71 fibroids was found in 23,541 hospital pregnancies, or an incidence of 0.3 per cent.

2. The course of pregnancy complicated by fibroids is so variable that a standardized form of treatment should not be attempted, but each case should be studied and treated individually.

3. It can be reaffirmed that the misnamed "elderly primipara" with a history of relative sterility is likely to harbor fibroids.

4. Interruption of pregnancy is frequent in the first trimester.

5. Myomectomy should be reserved for those patients with a history of repeated abortions and done preferably after the fourth month of pregnancy.

6. Radical operation, cesarean section with myomectomy or hysterectomy is safer than operative vaginal delivery.

7. Because of the dangers of fibroids associated with pregnancy, myomectomy should be done after one such experience before another pregnancy is permitted to occur.

8. The stimulation to the growth of fibroids by each pregnancy is an additional reason for myomectomy during an interval, lest permanent sterility result before a full-term, living infant may be obtained.

REFERENCES

- (1) Kosmak, G. W.: AM. J. OBST. & GYNEC. 6: 63, 1923. (2) Novak, E., and Martzloff, K. H.: AM. J. OBST. & GYNEC. 8: 385, 1924. (3) Witherspoon, J. F.: Endocrinology 17: 703, 1933. (4) Kelly, H. A., and Cullen, T. S.: Myoma of Uterus, Philadelphia, 1909, W. B. Saunders & Co., p. 459. (5) Graves, W. P.: Textbook of Gynecology, ed. 4, Philadelphia, 1929, W. B. Saunders & Co., p. 360. (6) Peterson, R.: Surg. Gynec. Obst. 46: 21, 1928. (7) Williams, J. W.: Textbook of Obstetrics, ed. 4, New York, 1919, D. Appleton & Co., p. 155. (8) Sampson, J. S.: Surg. Gynec. Obst. 14: 215, 1912. (9) Campbell, R. E.: AM. J. OBST. & GYNEC. 26: 1, 1933. (10) Watson, B. P.: AM. J. OBST. & GYNEC. 23: 351, 1932.

ACCIDENTAL INJECTION OF IODIZED OIL INTO UTERINE VEINS

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THE uterine cavity is lined by a single layer of epithelium. Not unreasonably, therefore, one would expect that fluids injected under pressure might penetrate into the subjacent tissues and secondarily into the circulation. Sixteen years ago Sampson,¹ using bismuth and barium, demonstrated that this could indeed happen. Later B  cl  re,² experimenting with injections of iodized oil into the extirpated uterus, found that pressures of from 400 to 500 millimeters of mercury were sufficient to force oil into the vascular network of the organ.

In 1929, Pujol y Brull, Vanrell, and Carulla Riera³ described five cases where, during the ordinary performance of hysterosalpingography upon the living patient, oil was accidentally injected into the utero-ovarian veins. Two more such cases have been reported by Witwer, Cushman, and Leucutia,⁴ and one by Solal.⁵ The last-named author refers incidentally to two additional cases, one in the practice of Riche and Fayot and the other in that of Cruz. My own case is, I think, the eleventh to be recorded.

There are three possible reasons to explain penetration of intrauterine oil into the blood vessels. The first is a solution of continuity of the endometrium, the result of functional desquamation, of neoplastic or other ulceration, or of operative trauma. Second, excessive pressure may force oil through the epithelial layer, even though this be intact and normal. A third explanation, advanced by Witwer, is that supernormal permeability of the endometrial tissues exists, as an idiosyncrasy, in a certain few women.

Surprisingly enough, in view of the theoretical dangers of embolism, this accident appears to produce no ill effects. Sicard and Forestier⁶ deliberately injected iodized oil into the peripheral circulation first of dogs, and later of human patients. They found that the oil was "pulverized" in the heart, and that the minute emboli which reached the lungs disappeared in the course of a few minutes, causing no symptoms. In Solal's case no less than 9 c.c. of oil entered one of the iliac veins; but the patient was so little disturbed that she went for a walk, in defiance of her physician's orders, later on the same day. Injection into the pelvic veins is labeled by Pujol y Brull "*un incident heureusement*

sans danger," and by Witwer, "entirely harmless, and without any clinical significance." This view is essentially confirmed by the facts in all of the 11 cases reported.

A physician and his wife came to my clinic in November, 1932, for investigation and treatment of a primary sterility of thirteen years' duration.

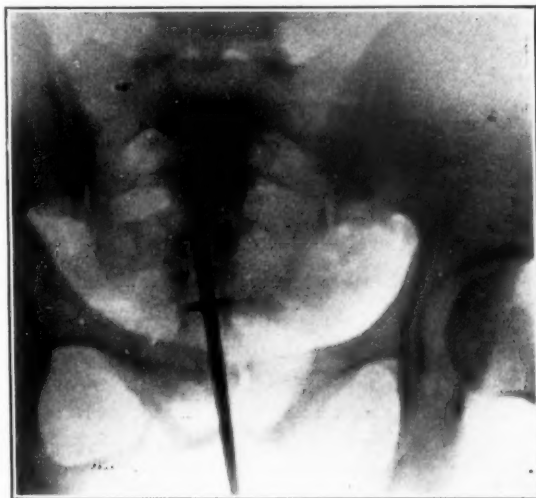


Fig. 1.—Diagnostic injection. Each tube is occluded at the uterine cornu.



Fig. 2.—First therapeutic injection. The interstitial portion of each tube has been opened.

During the first interview, the husband remarked that one feature, at least, of their case would require no attention, since two insufflations had already shown his wife's tubes to be normally patent. Nevertheless, it was deemed wise to repeat these tests since I have come to appreciate the uncertainty of observations thus reported at second hand.

An insufflation was done under atropine on November 16 and another on November 17 without preliminary medication. On both occasions gas pressures as high

as 200 millimeters of mercury failed to produce any pneumoperitoneum. On November 19 a hysterosalpingogram (Fig. 1) showed complete cornual occlusion of both tubes.

In this case of sterility, as in most others, a complete diagnostic study revealed several causative factors of infertility divided between the two partners. The



Fig. 3.—Second therapeutic injection. There is no improvement in tubal patency. A vague shadow marks the infiltration of oil into the myometrium. The uterine veins are heavily outlined.



Fig. 4.—Second therapeutic injection seen twenty-four hours later. Most of the oil has disappeared from the pelvis.

nontubal factors, however, were minor items easily corrigible, and so the wife's tubal condition became the chief problem of treatment and prognosis.

Salpingostomy is scarcely worthy of consideration except in cases of fimbriated-end occlusion. When blockades exist in other portions of the tubes, one has, as a rule, a far better chance of restoring patency by repeated therapeutic insuf-

flation of gas and injection of iodized oil. The cornual occlusions yield to oil somewhat more readily than to gas.

Accordingly I performed a therapeutic injection of iodized oil on Jan. 7, 1933. The maximum pressure developed was 300 millimeters of mercury at the syringe; this implies a considerably lower pressure in the uterus, since the inertia of a heavy fluid requires to be overcome within the apparatus. At this pressure it was possible to inject 7 c.c. of oil. The result appeared distinctly encouraging, for a hysterosalpingogram (Fig. 2) indicated that the interstitial portions of both tubes had been rendered patent.

On January 21 a second therapeutic injection was undertaken. The pressure previously used was not exceeded though I maintained it for a longer time. Seven cubic centimeters of oil were easily introduced. When an additional 4 c.c. entered slowly under the maximum pressure, I thought at first that the tubes had become permeable. This belief was dispelled by the hysterosalpingogram (Fig. 3), which showed the oil extensively distributed throughout the myometrium and within the veins of the broad ligaments.

The patient was hospitalized, and was watched with the greatest care. She manifested no disturbing symptoms or signs, either in the pelvis or in remote organs. A skiagram taken twenty-four hours later (Fig. 4) showed that the greater part of the oil had disappeared. I have now followed this case for a year, and am able to say that the patient has not been in any way adversely affected by the experience.

REFERENCES

- (1) *Sampson, J. A.*: Am. J. Obst., N. Y. 78: 161, 1918. (2) *Béclère, C.*: Gynéc. et obst. 14: 105, 1926. (3) *Pujol y Brull, A., Vanrell, J., and Carulla Riera, V.*: J. de radiol. et d'électrol. 13: 38, 1929. (4) *Witwer, E. R., Cushman, H. P., and Leucutia, T.*: Am. J. Roentgenol. 23: 125, 1930. (5) *Solal, R.*: Bulletin de la Soc. d'obst. et de gynéc. 21: 725, 1932. (6) *Sicard, J. A., and Forestier, G.*: Compt. rend. soc. de biol. 88: 1200, 1923.

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Martindale: Artificial Menopause, Brit. M. J. 2: 857, 1933.

L. Martindale reviews 620 cases of metropathia hemorrhagica, uterine fibrosis and fibromyomas and discusses methods of induction of artificial menopause and end-results. Surgical operation was chosen in 321 cases where there was doubtful pathology, increase in size of the uterus causing serious pressure symptoms, subperitoneal or submucous fibroids; 97.8 per cent of these cases were cured. Irradiation was used in 263 cases, where the patient was suffering from severe climacteric hemorrhage, the uterus only very slightly enlarged with an interstitial fibroid, where there was no suspicion of carcinomatous or sarcomatous degeneration; 94.2 per cent of these cases were cured. Irradiation, causing amenorrhea, also has been very effective in the treatment of tuberculosis and psychosis. Forty-five cases were treated with radium and only 68 per cent of cases were cured. Flushing, the most annoying and troublesome climacteric symptom, is less in the artificial menopause (less than 65 per cent), than in the natural one (79.4 per cent). There was noted increase in weight in 33.8 per cent of the operated and in 17 per cent of the x-rayed cases, whereas in normal women increase in weight occurred in 34.2 per cent of cases.

F. L. ADAIR AND IRA BROWN.

THE IMBEDDING OF THE OVUM IN TUBAL PREGNANCY*

A REVIEW

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BEFORE attempting to discuss the imbedding of the ovum in tubal pregnancy several factors must first be understood, namely:

1. That normally the spermatozoon meets the ovum in its descent through the tube and that the impregnation of the ovum takes place in the tube.
2. That some factor or factors must be present which either prevent or impede the impregnated ovum from descending through the tube and implanting itself in the uterine wall.
3. That the activity of the ovum in imbedding itself would not differ materially in its method of attack in the uterus, tube, or elsewhere.
4. That physiologically and histologically the tubal mucous membrane differs from the uterine endometrium. It undergoes no regular preparation for the reception of an impregnated ovum, and there is no thick endometrium into which the ovum may imbed itself.
5. That the stroma of the tube is very scant, and it usually does not form or undergo decidual changes to resist the digestive action of the trophoblast of the ovum.
6. That in the tube there is no thick muscular wall to hypertrophy and stretch around the ovum.

It is generally accepted that, when the graffian follicle ruptures the ovum escapes, surrounded by the zona pellucida and some of the adjacent cells of the discus proligerus. The spermatozoon penetrates these structures before it impregnates the ovum. While the exact function of these structures is not known, various theories exist.

In his Hunterian Lectures, Professor Robinson¹ has suggested that its cells (corona radiata) may provide pabulum for the growing ovum while the latter is still in the higher reaches of the fallopian tube. The length of time the ovum stays in the tube is still undetermined.

Grosser² suggests that the wandering of the human ovum takes from eight to ten days after fertilization before reaching the implantation area; during this time it loses its corona radiata and the zona pellucida. How much of this time is spent in the uterine cavity is not known. J. H. Teacher³ believes that the ovum lies free in the uterus for from four to five days and that it receives its nourishment from the secretion of the hypertrophic glands of the mucosa of the uterus (uterine milk). Grosser agrees with this; he believes that the secretion of the glands serves as an embryotrophy until the completion of the implantation. G. W. Corner⁴ states that "so far as is known, fertilization always takes place in the fallopian tubes, and

*Read before the Gynaecological and Obstetrical Section of the Baltimore Medical Society, May 6, 1933.

the fertilized ovum proceeds exactly as the unfertilized into the uterine lumen on the fourth day," and as it is generally accepted that implantation does not take place until the eighth or tenth day after fertilization (Patten and Hartman¹⁹), therefore we may assume that the fertilized ovum is free in the uterine cavity for about four to six days.

The very earliest stages of the implantation of the human ovum have not been observed. We have, therefore, to draw our conclusions from two sources. First, the imbedding of the ovum in experimental animals and second, by deduction from the earliest observed human ova. There have been about eight early human ova described. All the authors seem to agree that the earliest phases of the penetration of the human zygote into the uterine mucosa is probably similar to that of the guinea pig and that in its later phases of implantation and imbedding it more closely approaches the method of the hedge hog. Beyond these very earliest stages we have human material for study.

In Von Spee's²⁰ classical description of the imbedding of the guinea pig ovum, he states that about the sixth day after fertilization the ovum lies free in the uterus still surrounded by the zona pellucida. The wall of the ovum appears thicker at each pole. The cells of the implantation pole grow through the zona pellucida and attack the uterine epithelium and underlying connective tissue by digestion; the ovum then enters the cavity thus formed in the endometrium. The last entering cells of the ovum become firmly fixed to the margins of the opening in the uterine mucous membrane. From this point the guinea pig ovum diverges radically from the human being.

One may be allowed to conclude after studying the imbedding of the ovum in the guinea pig, hedge hog and human being that at a certain point in the development of the blastocyst, somewhere between the fourth and ninth day, it becomes imperative for the impregnated ovum to imbed itself for nourishment or perish. Anything which retards the descent of the ovum through the tube until this point is reached, will cause the blastocyst to imbed itself wherever it may be. It seems also reasonable to suppose that this imbedding time probably occurs earlier in tubal pregnancy than it does in uterine as there is no embryotrophy or "uterine milk" for it to feed upon. Whether the imbedding is due to the disappearance of the zona pellucida or to the developmental necessities of the ovum itself is not vital to us in our study.

In a previous study²¹ it was shown that tubal labyrinth, a condition probably caused by some previous low grade infection, was present in the tube in 90 per cent of a series of 45 ectopic pregnancies examined. Whether this condition caused the delay in the descent of the ovum is problematic but it cannot be ruled out. The influence pathologic embryos or pathologic ova may have in delaying the descent of the ovum or in causing an early imbedding of the ovum is also problematic. Mall²² in his study "On the Fate of the Human Embryo in Tubal Pregnancy"

showed that in 80 specimens examined only 16 per cent contained normal embryos, 25 per cent pathologic embryos, and 59 per cent pathologic ova.

Notwithstanding the large number of tubal pregnancies encountered it is difficult to obtain specimens early enough to study the various forms of imbedding. Tubal pregnancies in their very early stages give no symptoms and when symptoms are sufficiently well developed to establish the diagnosis or to require operation, hemorrhage has usually extended so far as to almost completely destroy all evidence of the imbedding. Experimental animals cannot be used as it is doubtful if ectopic pregnancy has ever been known to occur among them (Bland Sutton,⁸ Novak,⁹ Loeb and Hunter¹⁰). It is very difficult with this as a basis to describe what should be considered the normal imbedding of the ovum in tubal pregnancy. For this study we have one very early specimen and 65 late specimens.

It is assumed that the descent of the impregnated ovum through the tube is retarded until that point in its development is reached when it must imbed itself. It is our belief that the ovum follows a definite course in its imbedding, and it is this course which influences the pathology and symptomatology which the patient may present.

If we accept the theory of follicular salpingitis as the etiologic factor, we may assume that the ovum becomes lodged in one of the open ends of the pseudogland-like spaces and begins its development there, Fig. 1, if not then the ovum attaches itself at the point where it is stopped and proceeds to imbed itself (Fig. 2).

As soon as the ovum has gained its foothold it grows in one of three ways:

1. The major portion of the growth may be toward the lumen of the tube (Fig. 3).
2. The major portion of the growth may be toward the wall of the tube (Fig. 4).
3. The ovum may grow equally in both directions, toward the lumen and toward the wall.

These three types are not always sharply demarcated from each other. When the blastocyst imbeds itself it must be assumed that it attacks the tissues of the tube in much the same way as it does the tissues of the uterus. In the uterus, Teacher^{11, 12} states "the embryo destroys the uterine epithelium in its immediate neighborhood and the underlying tissues to an extent sufficient to open the maternal vessels." "The maternal blood flows from the opened vessels into spaces in the primitive ectoplacenta but more into a space between it and the decidua." This bleeding in the uterus is into a closed space as the penetration point in the endometrium has closed over the ovum. The trophoblast prevents the blood from coagulating and ultimately the blood finds its way back into the maternal circulation.

In the first type of imbedding where the ovum grows toward the lumen, the small portion of tube wall between the ovum and the tube lumen is quickly dissolved and the growing ovum projects into the cavity of the tube. This is called the luminal type of imbedding (Fig. 5). The ovum in this type has only a moderate attachment to the wall of the tube. The trophoblast of the ovum attacks the folds of the tube in a search for vessels for pabulum for the ovum. Wherever the trophoblast comes in contact with tubal epithelium the latter disappears (Fig. 6).

As the ovum projects into the lumen of the tube between the folds it does not

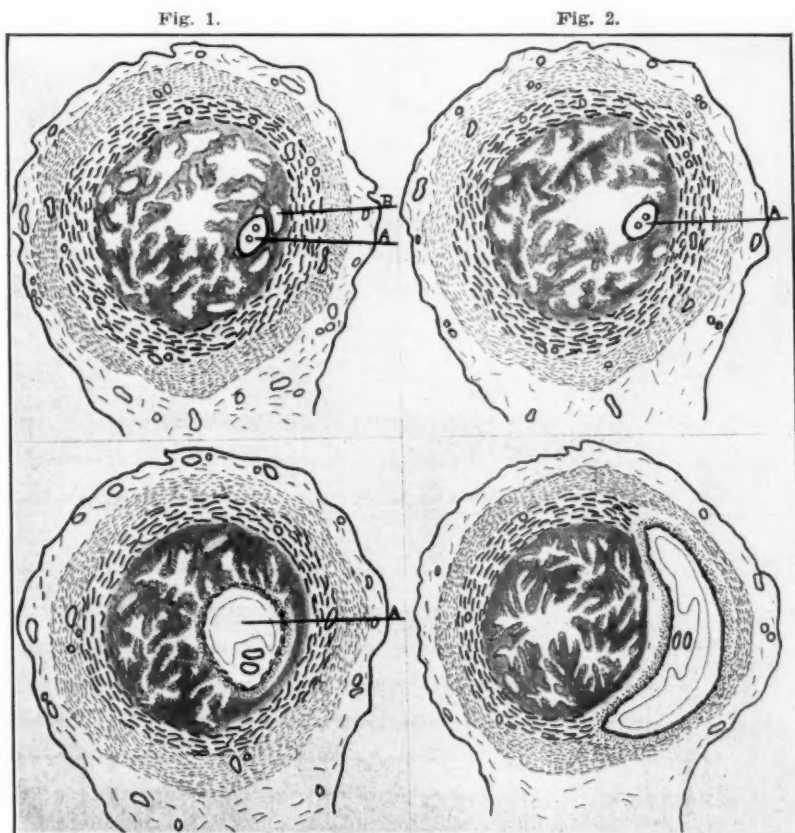


Fig. 3.

Fig. 4.

Fig. 1.—Diagrammatic cross-section of tube showing A, ovum caught in a pseudo-glandlike space B.

Fig. 2.—Diagrammatic cross-section of tube showing ovum A, beginning the imbedding process at the point where its descent through the tube was arrested.

Fig. 3.—Diagrammatic cross-section of the tube showing further development from Figs. 1 or 2 of ovum A. The major portion of the ovum growing toward the lumen of the tube.

Fig. 4.—Diagrammatic cross-section of the tube showing further development from Figs. 1 or 2 ovum A. Showing the major portion of the growth toward the wall of the tube.

lie in a closed space as is the case when the ovum is imbedded in the endometrium. Therefore, when the first small capillaries of the folds of the tube are opened and hemorrhage takes place, this blood surrounds the ovum and a definite portion of the blood goes directly into the lumen of the tube. It is this hemorrhage which may go forward (Fig. 7) and appear at the vulva or go backward and be expelled

from the fimbriated end of the tube into the peritoneum. It is agreed that in a fair proportion of cases the appearance of blood at the vulva is usually of uterine origin and means either death or separation of the fetus from its bed, but in a certain number of cases the blood must be of tubal origin. It is this initial hemorrhage into the tube which gives rise to the first symptoms of tubal pregnancy either

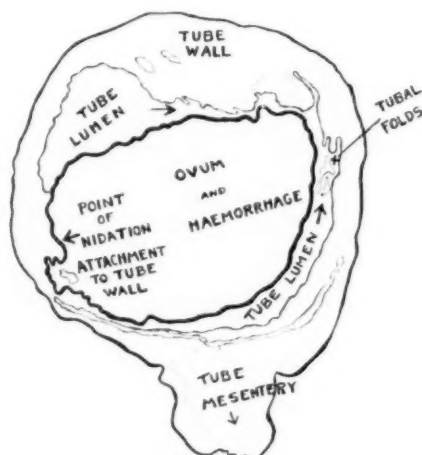


Fig. 5.—Diagrammatic representation of a microphotograph of a cross-section of an ectopic pregnancy of the luminal type of imbedding.



Fig. 6.—Microphotograph showing disappearance of epithelium when it comes in contact with trophoblast of the villi, luminal imbedding.

by peritoneal irritation from the blood or by sudden distention of the tube. Werth and Bandler¹³ described this form of imbedding calling it "columnar implantation." Litzenberg¹⁴ states, "I have always been skeptical of this type (columnar implantation) until Somerfield, who studied a very early ectopic tube in our laboratory, demonstrated the only one I have ever seen."

The luminal type of imbedding practically never goes on to rupture. It is usually operated on and diagnosed as an unruptured tubal pregnancy, or a tubal abortion. When the ovum develops in its normal, fairly slow growth, particularly if the placenta forms toward the broad ligament side, the tube in the luminal form of implantation gradually accommodates itself and the pregnancy may go on to or

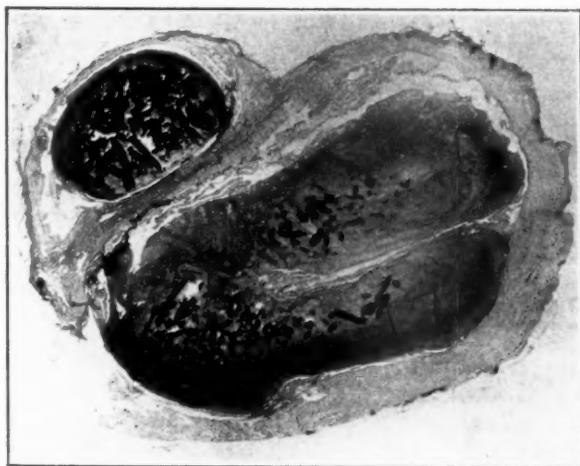


Fig. 7.—Two cross-sections of the tube close to the uterine end, showing canal filled with blood and compressing the villi.

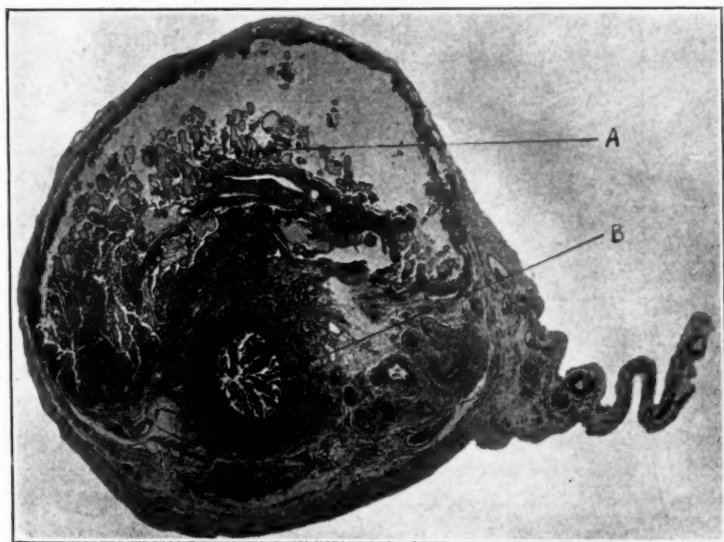


Fig. 8.—Very early tubal pregnancy showing mural imbedding; A, ovum in wall of tube, B, tube lumen.

near term. As a rule however, hemorrhage takes place with sudden distention of the tube, an acute abdominal crisis develops and operation is usually performed with or without the proper diagnosis. It is the bleeding, causing sudden distention of the tube or irritation of the peritoneum which gives the symptoms. An ectopic pregnancy gives no symptoms until hemorrhage takes place.

If the ovum eats its way into the wall of the tube, imbedding itself as it does in the uterus, we refer to this as the mural type of imbedding. As there is no thick mucosa into which the ovum may imbed itself, as is the case in the uterus, the ovum eats its way into the muscular wall of the tube (Fig. 8).

Aschoff¹⁵ describes a tubal pregnancy in which the trophoblast of the ovum lying in the wall of the tube almost completely encircles the lumen of the tube. Bandler calls this the centrifugal form. In the mural imbedding when the trophoblast opens the capillaries and hemorrhage takes place, it is into a closed cavity similar to the endometrium, and there is, therefore, no external bleeding into the peritoneum or into the lumen of the tube. If the vessels are small and the hemorrhage is slight, it acts as a pabulum to the developing ovum. If the vessel is larger, the hemorrhage may destroy the ovum and a tubal mole develop. This entire process

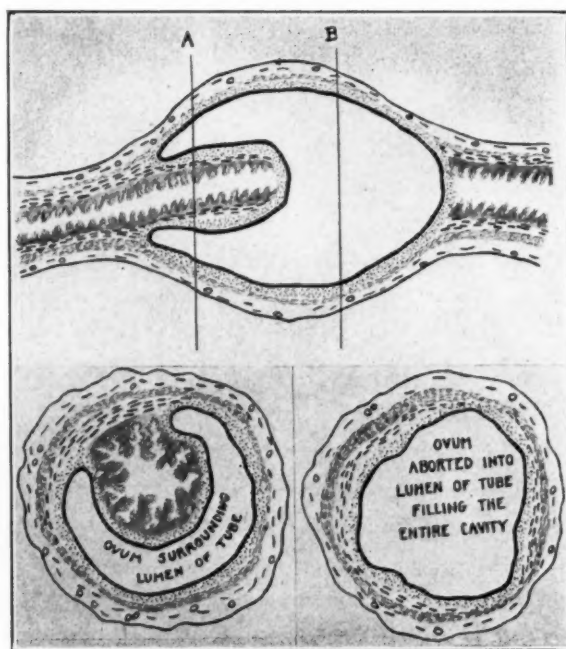


Fig. 9.—Diagrammatic reconstruction of serial sections of early ectopic pregnancy showing mural type rupturing into lumen of tube and how single sections taken at A or B would give entirely different microscopic pictures.

may give the patient very few or no symptoms. Should the ovum continue to grow the villi invade the musculature of the tube. Decidua formation is rarely found in the tube, therefore, the resistance to the invasion of the trophoblast is minimal, thus we may find areas in the tube where the trophoblast cells are almost directly under the serosa, in fact they may actually eat through the serosa making a small pinpoint opening through which hemorrhage later takes place into the peritoneal cavity. Bandler states that the vast majority of these so-called tubal ruptures are either erosions or due to erosion by the perforation of villi.

Our findings agree with this. We feel, however, that in a large measure before the erosion has extended far enough to eat away a substantial part of the tube wall a fairly large-sized blood vessel is opened, and the hemorrhage into this closed space causes the thin wall tube to rupture with the sudden expulsion of a large quantity of blood into the general peritoneal cavity. It is this type that gives

the clinical picture of the tubal rupture catastrophe. Occasionally the rupture may take place into the lumen of the tube, with hemorrhage into the lumen, in which case the ovum is either killed or aborted into the lumen of the tube. If it is aborted into the tube and not killed by the hemorrhage, the ovum may continue to grow in a manner similar to luminal or combined form of imbedding.

The third form of imbedding is a combination of the two forms already described. The ovum having lodged itself begins to grow, partially imbedding itself into the wall of the tube and also projecting into the lumen. This third form is called the luminomural or muroluminal according to which type of growth predominates the picture. Its clinical course may follow either the luminal or mural type, depending upon whether the phagocytic action of the trophoblast in eating

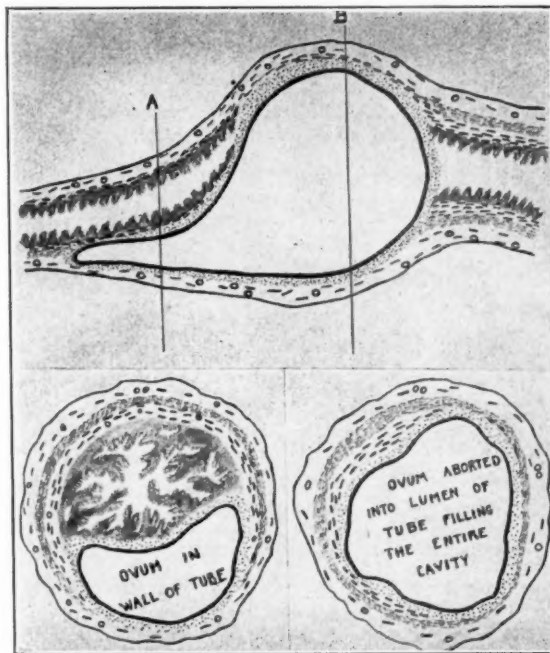


Fig. 10.—Diagrammatic reconstruction of serial sections of early pregnancy showing another method whereby the mural type of imbedding surrounds the lumen of the tube, ruptures into it and single sections at A and B show entirely different microscopic pictures.

into the wall of the tube or the growth of the ovum into the lumen of the tube, predominates. This form of imbedding occurs in the majority of tubal pregnancies. J. C. Litzenberg shows some remarkable sections of this form of imbedding.

It is not unusual in examining serial sections of early tubal pregnancies to see evidences which point to the possibility of a pregnancy beginning as a mural type gradually surrounding the lumen of the tube and ultimately digesting the lumen of the tube and converting itself into a luminal form (Figs. 9 and 10). The three types frequently overlap.

To what degree are we able to correlate the following facts? (a) point of implantation of the ovum, (b) type of imbedding, and (c) extent of hemorrhage.

The closer the implantation of the ovum is to the fimbriated end of the tube the more profuse the hemorrhage, because the vessels are larger and there is very little obstruction to the outflow of the blood toward the peritoneum. Due to this profuse hemorrhage free into the peritoneal cavity, the patient may present all the symptoms of tubal rupture catastrophe. This clinical picture although it may occur is rather unusual. The ampulla with its many branching folds, its rich stroma and its very thin wall of muscular tissue is more apt to have either the luminal or luminomural imbedding. The pure mural type of imbedding practically never occurs here. If the ovum is implanted near the fimbriated end of the tube the growth of the ovum plus the pressure of the hemorrhage behind, assisted by the peristaltic action of the tube may expel the ovum into the peritoneal cavity, without destroying the ovum and without severe hemorrhage, thus giving rise to a secondary abdominal pregnancy. This is the only true type of tubal abortion.

When the implantation is toward the middle of the tube or near the uterine end, and hemorrhage takes place, the flow of blood toward the peritoneal cavity is retarded due to clotting of the blood in the tube before expulsion. In implantation in this portion of the tube the hemorrhage may cause sufficient pressure upon the ovum to cause the death of the ovum with the formation of a tubal mole. These cases very often do not come to operation and may not be discovered until a laparotomy is performed for other or resulting pathology.

The closer we approach the isthmus of the tube with its less complicated stroma and its thicker wall the more apt we are to have the mural, or muroluminal type of imbedding with tubal rupture as a consequence. The nearer the imbedded ovum is to the uterine end of the tube the more frequently does the pregnancy end in a ruptured tube with tubal pregnancy catastrophe.

The acceptance of the active imbedding process of the ovum in mural imbedding would account for a large number of cases of ectopic pregnancies which have heretofore been described as occurring in tubal diverticula as described by Huffman.¹⁶ That tubal diverticula or branching tubes may be an etiologic factor in an occasional case, cannot be denied but its incidence is probably very small. We have only found one verified case in 185 ectopics.

J. W. Williams¹⁷ states: "I am of the opinion that these conditions can be more satisfactorily explained by supposing that the fertilized ovum had burrowed beneath the mucosa of the tube, just as it does in the decidua in uterine pregnancy." O. Hoehne,¹⁸ and Schoenholtz independently have described the possibility of small portions of the tube containing uterine mucosa. Should the ovum imbed itself in such an area a decidua would form as in the uterus and the decidual resistance to the trophoblast might be sufficient to allow some muscular development in the tube to accommodate itself to the pregnancy. This occurs rarely but when it does it is usually near the uterus.

CONCLUSIONS

1. The ovum follows a definite course in its imbedding: (a) Directly in the lumen of the tube, luminal type; (b) completely buried in the wall of the tube, mural type; (c) combination of both, luminomural.
2. There is a definite relationship between the type of imbedding and the pathology and symptomatology produced.
3. Ectopic pregnancies give no symptoms until hemorrhage takes place.

REFERENCES

- (1) Robinson's Hunterian Lectures, quoted by Johnstone: *J. Obst. & Gynaec. Brit. Emp.* 26: 231, 1914. (2) *Grosser, O.*: Embryology, Keibel and Mall, Philadelphia, 1910, J. B. Lippincott Company, p. 118. (3) *Teacher, J. H.*: *J. Obst. & Gynaec. Brit. Emp.* 31: 116, 1924. (4) *Corner, G. W.*: *Physiol. Rev.* 3: 461, 1923. (5) *Von Spee*: Döderleins Handbuch der Geburtshilfe, 1915, Wiesbaden. (6) *Falk, H. C.*: *AM. J. OBST. & GYNEC.* 15: 821, 1928. (7) *Mall, F. P.*: *Bull. Carnegie Inst. Embryology Wash.* No. 221, p. 961, 1915. (8) *Sutton, Bland*: *Lancet* 2: 1625, 1904. (9) *Novak*: *Arch. f. Gynak.* 117: 395, 1922. (10) *Loeb and Hunter*: *Penn. Med. Bull.* 21: 294, 1908. (11) *Bryce, T. H., and Teacher, J. H.*: Contributions to the study of the early Development and Embedding of the Human Ovum, Glasgow, 1908, John Maclehose and Sons. (12) *Teacher, J. H.*: *J. Obst. & Gynaec. Brit. Emp.* 31: 166, 1924. (13) *Bandler, S. W.*: Uterine and Tubal Gestation, New York, 1903, William Wood Co. (14) *Litzenberg, J. C.*: *Nelsons Loose Leaf Surgery* 7: 500, 1932. (15) *Aschoff, L.*: *Pathological Anatomy*, Jena, 1913, G. Fisher. (16) *Huffman, C. V.*: *J. A. M. A.* 61: 2130, 1913. (17) *Williams, J. W.*: *Obstetrics*, New York, 1903, D. Appleton and Co., p. 533. (18) *Hochne, O.*: *Halban-Seitz, Biologie und Path. des Weibes*. Berlin Wien 7: Part II, 1929. (19) *Patten and Hartman*: *Curtis Obstetrics and Gynaecology*, Philadelphia, 1933, W. B. Saunders Company 1: p. 406.

Béclère, C.: Hysterography in the Diagnosis of Intrauterine Lesions and of Functional Metrorrhagia, *Bull. Soc. d'obst. et de gynéc.*, p. 315, December, 1933.

The author reports a series of 125 cases of metrorrhagia unassociated with any evident clinical lesion. Among these there were 17 cases of uterine corpus cancer, 37 cases with benign uterine and adnexal surgical lesions and 58 cases of functional bleeding. After an experience with lipiodol injection in these cases over a period of eight years Béclère answers all the objections raised against the use of hysterography in these cases. In not a single case has he observed any infection following the use of iodized oil. The danger of disseminating cancerous material is purely theoretic just as it is in cases of carcinoma of the stomach and intestines investigated radiographically. Furthermore, in most cases the tubes were closed. The author has never encountered accidental injection of oil into a blood vessel in cases of uterine hemorrhage. He has observed this accident in cases of infantile uterus and after surgical salpingectomy.

Béclère analyzes his results and describes his technic. He emphasizes that hysterography does not replace curettement, biopsy or histologic examination but it indicates whether a lesion is intrauterine or not, and whether a biopsy is necessary. It indicates also the exact site of the lesion and therefore facilitates a biopsy.

J. P. GREENHILL.

THE EFFECT OF THE SHAPE OF THE PREGNANT UTERUS ON THE MECHANISM OF LABOR*

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THE usual conception of the shape of the pregnant uterus is that it is an oval- or pear-shaped organ with its long axis parallel with the long axis of the body. However, in the routine clinical examination of many women during pregnancy we have observed that the contour of the uterus especially during the last trimester varied considerably from this classical description, and that frequently the uterus was spherical and occasionally was transversely elliptical in outline. It was also observed that whereas the oval- or pear-shaped uteri had thick, firm, resilient walls, the spherical had softer, thinner, and less elastic walls, and the transversely elliptical had thin, flabby walls. Analysis of these observations led to the conclusion that the shape which the uterus assumes during pregnancy is dependent on the tonicity of its musculature.

An artificial classification of the uteri into conical, conospherical, sphericoconical, and spherical was made for the purpose of study, and tables, consisting of 400 cases, one hundred in each group, were constructed.

The conditions which were found to have an effect in lessening the tonicity of the uterine muscle and so causing an alteration in its shape were first, parity (Table I); second, age (Table II); third, previous

TABLE I

	CONICAL	CONOSPHERICAL	SPHERICOCONICAL	SPHERICAL
PARA I	97	17	12	3
Para ii	3	48	26	5
Para iii	0	22	30	10
Para iv	0	7	19	20
Para v	0	6	4	26
Para vi	0	0	7	4
Para vii	0	0	2	9
Para viii and over	0	0	0	23

dystocia; fourth, debilitated condition of patient with poor tonicity of muscle system in general as a result of present or past illness; fifth, multiple pregnancies and hydramnios; sixth, more than one of the previously mentioned factors with a correspondingly greater degree of alteration in the shape of the uterus (Table III). Table IV con-

*Read at meeting of the Obstetrical Society of Philadelphia, March 1, 1934.

TABLE II

AGE	CONICAL	CONOSPHERICAL	SPHEROCONICAL	SPHERICAL
15 to 20 years	39	16	7	0
21 to 25 years	44	35	28	11
26 to 30 years	11	33	34	29
31 to 35 years	3	10	18	23
36 to 40 years	0	4	12	27
Over 40 years	0	0	1	7
Age not noted	3	2	0	3

TABLE III

	CONICAL	CONOSPHERICAL	SPHEROCONICAL	SPHERICAL
Previous dystocia	0	30	40	55
Previous disability	13	28	38	45
Present disability	15	16	30	46
Hydramnios	0	2	3	3
Previous multiple pregnancy	0	0	0	3
Present multiple pregnancy	0	0	2	3
More than one of above	6	19	50	66
Contracted pelvis	59	58	51	36

structed to show the effect the shape of the uterus in determining the time of the onset of labor gave negative results except that in this series premature labor was notably more frequent in the spherical and sphericonical-shaped uteri.

TABLE IV

DATE OF EXPECTANCY	CONICAL	CONOSPHERICAL	SPHEROCONICAL	SPHERICAL
1 week or more past	15	19	13	14
1 week or more before	25	21	17	19
Premature labor	2	4	7	7
Date not noted	13	10	10	20

In Table V it will be noted that abnormal positions and presentations are much more common in the spherical and sphericonical-shaped uteri than in those of conical and conospherical form.

Table VI shows that while the average duration of labor was shorter in the less normal shaped uteri yet very long labors, i.e., over thirty hours, are about as common in one group as in the other.

TABLE V

POSITION AND PRESENTATION	CONICAL	CONOSPHERICAL	SPHEROCONICAL	SPHERICAL
Vertex first position	55	64	49	44
Vertex second position	32	30	32	31
Vertex third position	2	2	7	4
Vertex fourth position	8	0	7	6
Breech	3	1	4	6
Transverse	0	0	0	4
Face	0	0	1	0
Position not noted	2	1	2	8
Twins	0	0	2	3

The incidence of selected complications of labor was studied in Table VII, and it is noteworthy that precipitate labor, primary inertia, and postpartum hemorrhage are much more frequent in patients whose uteri are spherical or sphericoconical in outline.

TABLE VI

TIME OF LABOR	CONICAL	CONOSPHERICAL	SPHEROCONICAL	SPHERICAL
5 hours or less	4	31	24	22
6 to 10 hours	25	31	22	30
11 to 15 hours	21	14	24	17
16 to 20 hours	18	8	6	9
21 to 30 hours	18	4	7	2
31 to 40 hours	7	1	5	5
Over 40 hours	6	2	3	3
Time not noted	1	9	9	12

TABLE VII

COMPLICATIONS IN LABOR	CONICAL	CONOSPHERICAL	SPHEROCONICAL	SPHERICAL
Cord around fetus	6	13	6	7
Prolapse of cord	1	1	0	1
Fetal distress in labor	9	3	6	6
Precipitate labor	0	9	17	14
Premature rupture of membranes	4	2	5	8
Artificial rupture of membranes	1	3	5	4
Inertia primary	4	1	3	10
Inertia secondary	1	2	2	3
Postpartum hemorrhage	7	5	4	16
Asynclitism	1	3	0	3
Placenta previa	1	3	2	3
Abruptio placentae	0	0	2	2
Maternal distress in labor	2	0	0	2
Dystocia in present labor	41	17	20	25

TABLE VIII

WEIGHT OF BABY	CONICAL	CONOSPHERICAL	SPHEROCONICAL	SPHERICAL
3 to 4 pounds	1	0	1	1
4 to 5 pounds	1	2	0	0
5 to 6 pounds	4	4	5	5
6 to 7 pounds	16	15	15	15
7 to 8 pounds	34	33	21	22
8 to 9 pounds	20	20	33	20
Over 9 pounds	7	6	6	14
Weight not noted	17	20	21	26
Twins	0	0	2	3

Table VIII shows nothing significant and was inserted only as a check on other data.

The operative incidence as shown in Table IX is of interest because of the more serious obstetric operations, version and cesarean section, 13 out of 15 were performed on patients who had spherical or sphericoconical shaped uteri.

The results of these 400 labors are tabulated in Table X, and it was

surprising to find that 13 out of 14 stillbirths occurred in the spherical and spheroconical groups and that all of the maternal deaths occurred in these same groups.

TABLE IX

OPERATIVE DELIVERIES	CONICAL	CONOSPHERICAL	SPHEROCONICAL	SPHERICAL
Instruction forceps	9	3	1	0
Low forceps	10	5	4	1
Mid forceps	10	2	1	2
High forceps	1	0	0	0
Scanzoni maneuver	5	0	2	1
Version and extraction	0	0	1	5
Breech extraction	0	0	1	4
Cesarean classical	1	1	1	3
Cesarean extraperitoneal	0	0	0	2
Braxton-Hicks version	0	0	0	1

TABLE X

RESULTS	CONICAL	CONOSPHERICAL	SPHEROCONICAL	SPHERICAL
Stillborn	1	0	4	9
Baby died in ten days	2	2	1	2
Puerperium morbid (puerperal)	21	12	11	17
Puerperium morbid (nonpuerperal)	4	1	2	3
Mothers died	0	0	1	3

This study has led to the conclusion that the term egg-shaped would more properly describe the contour of the normal uterus in the last trimester of pregnancy, the more pointed end of the egg being represented by the isthmus and the blunt end corresponding to the fundus. The long axis of this egg-shaped organ lies parallel with the long axis of the body and its greatest width is along a line between the two cornua.

If the above description of the shape of the normal uterus is kept in mind it is easy to see how it may be a factor in determining the time when engagement of the presenting part occurs, because during pregnancy the intermittent contractions of the uterus can exert no expulsive force on the fetus as long as it is surrounded by the amniotic fluid, due to the law governing the transmission of force through a liquid. It is only when the increasing size of the fetus near term causes the presenting part to come in contact with the converging walls of the uterus and thus breaks the continuity of the fluid surrounding the fetus, that the force of the uterine contractions is exerted on the fetus and tend to force it into the pelvic inlet. Flexion of the head is also facilitated by a normal shape of the uterus because the force of the contraction is transmitted along the spinal axis against the resistance of the smoothly lined walls of the funnel-like lower part of the egg-shaped uterus.

The fact that engagement and fixation of the presenting part occur earlier, as a rule, in primiparas is due to the greater frequency of normal egg-shaped uteri in these patients. Engagement or fixation of the presenting part seldom occurs in women with spherical or transversely elliptical-shaped uteri before the membranes rupture.

CONCLUSIONS

1. The shape of the uterus in pregnancy is determined by the tonicity of its musculature.
2. A recognition of the shape of the uterus is of importance, because it is a valuable prognostic sign as to the liability of the individual patient to some of the more serious complications of labor, e.g., abnormal positions and presentations, postpartum hemorrhage, primary and secondary inertia, and precipitate delivery. Premature labor and stillbirths are also more common in patients having spherical and sphericoconical uteri.
3. The shape of the uterus is a factor in determining when engagement and fixation of the presenting part occurs.
4. In classifying the various types of uteri, it is suggested that instead of the artificial grouping used in this study that the terms egg-shaped, elliptic, spherical and transversely elliptic, be used.

3658 FRANKFORD AVENUE

DISCUSSION

DR. PHILIP F. WILLIAMS.—Dr. Laferty's observations on the contour of the abdomen in pregnancy in relationship to the type of labor are stimulating. An abdominal examination not only discloses malpresentations but disproportions between the head of the child and the pelvis of the mother, the too pendulous abdomen of some multiparous women as well as the physical development of the woman and the capacity of her pelvis. The altered contour of the abdomen in cross-births has long been recognized but it is apparent that the palpation of the head above the brim of the pelvis is not sufficiently recognized as an indication of malposition or disproportion. I feel that one of the most difficult points we have to get across to the students is their uncertainty regarding definition and the manner of determination of the engagement of the head. This can be sufficiently determined in most cases by abdominal examination.

I would call attention also to the fact that in posterior positions of the vertex the size of the uterus opposite which the back lies very frequently has a particularly flat contour. It is certain that from time immemorial the flaccid uterus of the multipara has been known to be aided by particular postures in parturition which we imitate today in the exaggerated lithotomy position as well as the use of pads and binders.

ANOTHER METHOD OF ANESTHESIA IN OBSTETRICS

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THE alleviation of pain in labor has been a more or less constant problem to the medical profession for the past half century. In spite of recent advances we are still sorely in need of a suitable anesthetic in obstetrics. We possess no drug which is without danger to either mother or child. Since all efforts to reduce the dangers of these drugs to a negligible minimum have failed, it is, therefore, necessary that we turn our efforts toward an entirely different method. Regional anesthesia has been so successfully developed in other fields of surgery that it seems only logical that we turn to this in obstetrics.

In 1923 Bonar and Meeker recommended sacral nerve block in obstetrics. This has since been held as practical when general anesthesia was considered too dangerous. However, it has never become popular with the practitioner because the procedure was somewhat difficult and required considerable technic, eleven injections being necessary for a complete sacral block.

Before regional anesthesia can become popular in obstetrics two very important difficulties must be overcome. The procedure must be simplified and the fiber tracts supplying the uterus and perineum be definitely determined for paraneural injection. In the July, 1933, issue of *Surgery, Gynecology and Obstetrics*, J. G. P. Clelland presented conclusive evidence that the pain caused by the uterine contractions could be abolished by a paravertebral injection of novocaine at the eleventh and twelfth thoracic roots, thus definitely tracing the afferent nerve impulses from the uterus.

The purpose of this paper is to demonstrate that perineal pain can be abolished without affecting the uterine contractions by a parasacral block of the third sacral nerve roots and to provide clinical proof that the greater amount of pain experienced through stretching of the birth canal is transmitted by the third sacral nerve roots. With proper preliminary analgesia, an ideal delivery can be completed in conjunction with a third sacral nerve block. It should be stated here that this work was completed previous to the publication of the recent findings regarding the abolition of uterine pain by a paravertebral injection of the eleventh and twelfth thoracic nerve roots, and it seems logical to conclude that the two methods could be combined advantageously, thus eliminating the dangers incurred by the use of sedative drugs to pro-

duce an amnesia of the abdominal pain. It is to be regretted that no such cases have been experimentally recorded in my series. This report concerns the perineal anesthesia obtained by a third sacral nerve block with the use of a sedative as a means to alleviating the abdominal or uterine pain.

Although present knowledge presents a mass of conflicting evidence as to the definite afferent nerve tracts supplying the uterus and perineum, it is generally agreed that the pain in labor is made up of two components, that which is caused by the uterine contractions and which, as recently recorded, is transmitted by the eleventh and twelfth thoracic nerve roots, and that which is due to the stretching of the birth canal and which, heretofore, has been regarded as being transmitted by certain undetermined sacral nerve roots. It has not been definitely determined if these two components act independently of each other. The evidence regarding this is conflicting. Behan considered the fibers arising solely from the second, third, and fourth sacral nerve roots. Clinical observations although always indefinite regarding pain and sensation, show the pain to be situated between the tenth and twelfth thoracic and the second and fourth sacral regions. Although it has been experimentally proved that the afferent nerve supply of the uterus was transmitted by the eleventh and twelfth thoracic roots, and that a paravertebral block of these nerve roots completely abolished uterine pain, it was found clinically in this series of cases that on injection of the third sacral nerve roots the uterine pain was definitely partially abolished in all of the cases. In a few of the cases the amount was apparently negligible but even in these, some relief of the abdominal pain could be observed. This observation would lead one to believe that there is some connection between the eleventh and twelfth thoracics and the third sacral nerve roots in the transmission of afferent impulses from the uterus, with of course the greater majority of impulses being transmitted via the thoracic nerve roots. However, the primary purpose of this paper is to determine the nerve roots over which the perineal pain impulse is transmitted.

In the effort to determine these nerve roots it is only logical to attempt to anesthetize the third sacral root because it is the largest root of the sacral plexus, and gives origin to the pudendal plexus which supplies the perineum. By injecting novocaine in the third sacral foramina it was found that most of the perineal pain was abolished and some of the uterine pain relieved, thus providing evidence sufficient to conclude that the third sacral nerve root must be the fiber tract through which the pain impulse experienced by the stretching of the birth canal is transmitted. It must be admitted that not all of the perineal pain was abolished. However, an absolute abolition of all perineal pain was not

expected since there are many cutaneous and muscular branches arising from the ilio-inguinal and genitofemoral nerves which arise from the lumbar plexus and which naturally would not be affected by a third sacral block. Sufficient anesthesia was obtained, however, for a practically painless delivery.

METHOD OF PROCEDURE

In this series of 50 cases, 48 were primiparas, twenty having had some form of preliminary drug analgesia and 30 having had no preliminary drugs. The cases were not selected but were taken from the routine type of patient, varying in ages from sixteen to twenty-eight years. Thirty patients were delivered without any attempt to produce an amnesia so that the full effect of the third sacral block could be observed. In this group the patient was observed until the cervix was completely effaced. The patient was then placed on the delivery table on her side, and the lower lumbar and sacral regions were carefully prepared with iodine and alcohol. The third sacral foramen was most easily found in the following manner: The inferior aperture of the sacral canal was palpated just above the articular surface of the coccyx, the posterior superior spine of the ileum was found, at a point one-half the distance between these two landmarks or about two and three-fourths inches from either landmark and three-fourths inches from midline, where a small protuberance could be palpated on the sacrum. A three-inch needle was inserted directly medial to this protuberance. One can usually insert the needle into the foramen, or can explore this area with the needle until it "falls" as it were into the foramen. The patient usually experiences pain either in her hip or leg if the foramen is probed directly. Five to 10 c.c. of sterile novocaine solution was used for the injection.

The amount of anesthesia obtained by this injection and the time of onset of the anesthesia was estimated by a determination of the degree of cutaneous anesthesia, which was done by grasping the skin of the perineum with a forceps and noting the reaction of the patient. The average time for partial anesthesia to arise was six minutes and the maximum amount of anesthesia was usually obtained in eight minutes. The degree of anesthesia in most cases was slight sensation after sustained pressure of a few seconds with the forceps completely approximated and latched in the first notch.

As soon as the anesthetic became complete, the patient in the majority of instances was observed to be greatly relieved of pain. Those who were previously uncontrollable and who complained severely with each abdominal pain would lie quietly on the table and cooperate with each contraction by pulling vigorously on the bedstraps and holding their breath as directed. They would sleep between uterine contractions while the head was presenting in over one-third of its diameter. In each case the head was allowed to slowly dilate the perineum, and the mother did not experience pain when the perineum was fully stretched and the occiput engaged behind the pubis. Many of the mothers were not aware of the fact that their babies had been delivered, although their perineums were very rigid and in which it was debatable as to whether or not an episiotomy would be necessary for delivery.

Thirteen episiotomies were performed without further anesthesia. Four of the 13 mothers knew nothing of the procedure, two complained severely and described the pain as that of cutting, the remaining 7 complained of a burning or slightly painful sensation after sustained pressure was made with the scissors, but the pain was only momentary and not severe. In all but three of these patients the repair was completed without the injection of novocaine locally, or without pain except in the im-

mediate skin layers. When 2 or 3 c.c. of novocaine were injected intradermally in the line of incision, the incision and repair were both absolutely painless.

When it was concluded that the perineal anesthesia was sufficient for a painless delivery, 20 patients were delivered using drug analgesia in conjunction with sacral anesthesia. In 13 patients sodium amytal (by mouth) was used. Morphine and hyoscine was used in 5 of the patients and in 2 cases phanodorn was administered. The result was much more practical with this group of patients since there was an amnesia throughout the labor and the patient was not fully conscious of the abdominal pains during the actual delivery. Small doses only of the above-mentioned drugs were necessary, since a greater amount of pain was abolished with the sacral anesthesia.

The perineum was definitely relaxed from the third sacral nerve block. Twenty-eight of the 50 patients were delivered without an episiotomy or laceration by more or less inexperienced obstetricians. The perineum was much more resistant to the fingers before the anesthetic was complete than after. One of the outstanding features noted with this type of anesthesia was that the second stage of labor was actually shortened. The patients were fully conscious, yet had no perineal pain and as a result labored more vigorously with their contractions. Many of the patients who were progressing extremely slow during the first stage of labor delivered within thirty minutes after parasacral anesthesia was administered. The average time required to expel the fetus after the injections were made was forty-one minutes. In one patient the second stage of labor was not completed for two hours. Only 11 of the patients required one hour, the remainder all completing the delivery within five to fifty minutes after the anesthetic was administered, the anesthetic retaining its effect for approximately two hours.

Another advantageous feature with this type of anesthesia is the prevention of many relaxations and lacerations, since the head can be allowed to slowly present itself and thus slowly dilate the birth canal without discomfort or pain, which eliminates the danger of sudden expulsion of the head and resultant deep laceration of the perineum. The patient who is carried through the delivery under gas or drug analgesia usually experiences extreme pain at the time the perineum is fully stretched, and as a result of this pain she cries out and automatically expels the head with such force that it is difficult to control its progress properly.

In 3 patients forceps and extraction was attempted: the patients experienced considerable discomfort but had no actual severe pain. However, in two of the patients, sufficient uterine relaxation was not obtained to complete the delivery conscientiously, and the third patient was delivered, but with great difficulty. If a case arose where forceps and extraction was absolutely necessary the procedure could be completed safely.

One might ask, why go through with this more or less difficult procedure when a local infiltration of the perineum will yield approximately the same results. This type of anesthetic is more desirable because it is not much more difficult to use, and it does not endanger the perineum by separation of fascial layers and devitalization of tissues as does local infiltration.

No contraindications have been observed in the use of sacral anesthesia. It can be used without fear of ill-effect on mother or baby, it relieves the pain during labor, promotes relaxation of the perineum, and the actual time of the delivery is considerably shortened.

The following six brief case reports are presented to illustrate the typical cases from which the conclusion has been drawn:

CASE 1.—A primipara, Mrs. E. M., aged seventeen, was admitted to the St. Louis City Hospital in active labor Feb. 8, 1933, at 1:35 A.M. Rectal examination showed the cervix to be dilated to a diameter of about three fingerbreadths, and the membranes were visible. The uterine contractions were forceful and caused the patient to cry out loudly for relief in an hysterical manner. Six grains of phanodorn were administered per os on admission, after which the patient lapsed into a drowsy indifference between uterine contractions, but continued to complain severely with each abdominal pain.

With the patient on her left side at 1:45 A.M., the third sacral nerve roots were injected parasacally with 8 c.c. of sterile novocaine solution. Partial anesthesia as evidenced by perineal cutaneous anesthesia and by beginning relief from abdominal pain was noticed three minutes following the injection. After twelve minutes the anesthetic had taken effect so completely that the reaction of the patient was a complete contrast to that which it had been before the injection. The patient was conscious of each contraction but complained of only slight abdominal pain and of a perineal numbness. She became ideally cooperative. The uterine contractions continued apparently unaffected, the time interval and duration of the contractions remained unchanged. After forty-five minutes the patient delivered a normal full-term fetus without knowledge of the procedure, and could not be convinced that the delivery had taken place until the child was shown to her. An episiotomy was not necessary although the perineum was moderately rigid. The placenta was expressed intact at 2:45 A.M. with a normal amount of hemorrhage. The baby cried well and spontaneously. No toxic effects were noted.

CASE 2.—Parasacral block with novocaine, without the use of drug analgesia.

Mrs. F. S., aged twenty-one, gravida i, entered the hospital at 2:30 A.M., March 8, 1933, having been in active labor forty-five minutes. She complained constantly of strong abdominal pains at four- to five-minute intervals lasting from twenty to thirty seconds. Progress was extremely slow and the patient was not cooperative, refusing to bear down with her pains, and moaning constantly. After the first stage of labor was completed, which was after sixteen hours, the third sacral roots were injected parasacally with 10 c.c. of sterile 1 per cent novocaine solution. The patient was greatly relieved after three minutes, and complained of no perineal pain, but had considerable pain in her back of which she complained severely. The patient, however, became cooperative in her efforts to expel the fetus.

The perineum was extremely rigid and an episiotomy was deemed advisable. A right oblique incision was made about one and one-half inches in length, the patient complaining only of a burning sensation at the time of the incision. A normal child was delivered twenty-five minutes after the parasacral injection, with no perineal discomfort to the mother. The placenta was expressed by a modified Credé method and was intact. The patient complained considerably when the superficial repair of the episiotomy was attempted, the deeper layers were approximated, however, without pain to the mother. Three cubic centimeters of novocaine solution were injected into the skin layers and the repair was completed without pain. The following day the patient was convinced only with difficulty that an episiotomy had been performed. No abnormalities were noted postpartum.

CASE 3.—Parasacral block with novocaine, morphine, and hyoscine as the analgesic.

Mrs. M. G., aged nineteen, a primipara at term who was not in active labor at the time of admission to the hospital. At 11 A.M. an attempt to induce labor

with castor oil, quinine, and soap suds enemas was made. At 7 P.M. the patient began complaining of abdominal pains. The contractions were forceful, occurring every four or five minutes and lasting about one minute. The patient cried out for relief with each contraction. When the cervix was dilated to two fingerbreadths in diameter, one-sixth grain of morphine and one one-hundred and fiftieth of hyoscine were given hypodermatically, after which the patient became drowsy and complained less. The dose was not repeated, and at 4:00 A.M. when the cervix was completely effaced, the patient was again completely conscious of the contractions, holding her hand to her perineum and complaining severely of perineal pain. At this time a parasacral block was attempted using 6 c.c. of sterile novocaine solution. After eight minutes the cutaneous area of the perineum was completely anesthetized, the patient having no sensation whatsoever and complaining no more. At 4:30 A.M. a normal full-term fetus was delivered, the mother having no knowledge of the procedure except for a feeling of abdominal emptiness. The head was allowed to slowly dilate the birth canal, and at the time the canal was fully stretched, the mother was not affected and complained of no discomfort or pain. The placenta was delivered after twenty minutes without difficulty and without abnormal hemorrhage. The fundus was firm and the perineum well preserved.

CASE 4.—Parasacral block with amytal and hyoscine.

Mrs. F. Z., a gravida i, aged twenty-four, entered the St. Louis City Hospital Feb. 18, at 4:00 P.M. with a history of onset of labor at 10:00 A.M. the preceding day. The uterine contractions were strong and apparently painful although the patient was unusually cooperative. Six grains of amytal by mouth and one one-hundred and fiftieth of hyoscine hypodermatically were administered at the time of two fingers' dilatation of the cervix. The patient was drowsy and slept between contractions thereafter, but complained of severe abdominal and perineal pain during the contractions.

Six cubic centimeters of 1 per cent sterile novocaine solution were injected into the third sacral foramina at the time of complete effacement of the cervix. The perineal cutaneous pain was not completely abolished, but analgesia was present to deep pinching. The patient complained of severe pain in her back and of moderate abdominal pain throughout the later stages of labor and at the time of actual delivery this pain was more severe. The patient also complained of a dull perineal pain and was conscious of the fact that the head was passing through the birth canal, but did not suffer actual pain to any great extent, later remarking that the perineal discomfort was not that of pain but rather of a pulling sensation. In the process of the delivery a first degree laceration occurred and was repaired without pain or sensation. The placenta was delivered after thirty minutes with considerable hemorrhage and the retention of small portions of placenta. The postpartum course was normal, the fundus firm and the perineal repair healed by first intention.

CONCLUSIONS

1. The pain in labor that is due to the stretching of the birth canal is transmitted by afferent fibers through the third sacral nerve roots.
2. Parasacral block of the third sacral nerve roots anesthetizes the perineum sufficiently for a practically painless delivery without affecting the tone of the uterus.
3. The afferent nerve supply of the uterus is connected by undetermined fibers with the third sacral nerve roots, since partial relief

from abdominal pain was observed following the injection of the third sacral roots with novocaine.

4. The combination of parasaeral anesthesia and drug analgesia is feasible in obstetrics, with certain definite advantages over other types of anesthesia in obstetrics.

4981 THRUSH AVENUE

BLEEDING TIME AND COAGULATION TIME IN THE NEWBORN

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DEATH following a circumcision by a Jewish rabbi in a baby, born spontaneously, who had made normal progress in the first eight days, prompted an investigation of the bleeding time and the coagulation time in the newborn. The bleeding time and coagulation time of this baby was four minutes each. There were apparently no bleeders in the immediate family nor a suggestion of hemophilia in preceding generations.

Oozing continued from the circumcision wound and even from the urethra for thirty consecutive hours in spite of the usual procedures used to stop it.

To determine the average bleeding time and coagulation time of infants at birth under the same conditions and technic, from the skin and mucuous membranes and the change at the end of six weeks, a study was made of 100 babies born consecutively at the obstetric service of the Denver General Hospital. The technical work was done by one of the authors in the department of clinical pathology. The tests were made from the heel and the under portion of the upper lip in the first twenty-four hours after birth and again after about six weeks.

TECHNIC

The cushion of the heel was first sponged with 95 per cent alcohol then dried with cotton, in order to clean the skin. A prick was made with a spring lancet with the blade set at 3 mm. When the drop of blood appeared the stop watch was started and one end of a capillary pipette, 1.5 mm. in diameter, was touched to the drop and the pipette allowed to fill. When the drop did not appear immediately another prick was made following slight massage of the entire leg. Never was the heel squeezed in order to make the blood flow. When the pipette was filled it was laid to one side while the bleeding time was determined. Blotting paper from a

Tallqvist hemoglobinometer was touched lightly to the prick in the skin every few seconds until bleeding ceased. Time on the stop watch was then noted and the bleeding time recorded.

At the end of two minutes following the appearance of the blood small portions of the filled pipette were broken off and when stringing of the blood appeared on breaking the pipette, time on the stop watch was noted and the coagulation time recorded. When, on breaking the pipette at the end of two minutes, it was found that coagulation had already occurred another test was made, this time beginning the breaking of the pipette fifteen seconds following its filling.

The upper lip was pinched gently but firmly between the forefinger and thumb of the left hand in such a way that a portion of the mucous membrane just inside the lip was exposed. The lancet prick was made in the mucous membrane. Both the bleeding time and the coagulation time from a prick on the lip were determined in the same way as was that on the heel.

RESULTS

Coagulation and bleeding time were determined on 102 babies within twenty-four hours after birth. These tests were repeated on 54 of these children when they were about six weeks old. The average, minimum and maximum figures obtained were tabulated. Bleeding time within twenty-four hours after birth showed a maximum of 6 minutes, but this occurred in one baby only. Another child reached 4 minutes and 35 seconds. Two reached 3 minutes, and 6 reached 2 minutes or a little over. The remainder of the results were less than 2 minutes. Thirty-one were less than 1 minute. The average of all 102 babies was 1 minute and 9 seconds.

The bleeding time at the end of an average age of forty-four days was also noted. Unfortunately the child having a bleeding time of 6 minutes when it was twenty-four hours old did not return for a repeat test at the end of six weeks. Neither did the one having a bleeding time of 4 minutes and 35 seconds. One of the two who showed a bleeding time of 3 minutes when twenty-four hours old, at the end of forty-three days showed a bleeding time of 1 minute and 45 seconds. Out of the 54 children who were tested at this time only 4 (7 per cent) reached a maximum of 2 minutes. Twenty-nine (53 per cent) showed an increase in the bleeding time while 25 (47 per cent) showed decrease in the bleeding time. The average time for the 54 babies at the end of forty-four days showed a slightly lower bleeding time (1 minute, 5 seconds) than the 102. This, however, is for all practical purposes the same. Also the average bleeding time of the same 54 babies did not change materially from that taken at birth (1 minute, 7 seconds) when compared with that determined at the end of forty-four days (1 minute, 5 seconds).

The maximum bleeding time taken from a prick in the lip was 5 minutes and 45 seconds. It is interesting to note that this result was obtained on the same child as was the 6-minute bleeding time obtained from the heel. The next longest result was 5 minutes from the lip of the same child who gave a bleeding time of 4 minutes, 35 seconds from the heel. One of the two children who showed a bleeding time of 3 minutes from the heel showed the same result from the lip. The other of the two showed a much shorter bleeding time from the lip, 1 minute, 10 seconds. Of the 87 children tested for bleeding time from the lip, 60 of them (69 per cent) showed a longer time than they did when pricked on the heel; 21 (24 per cent) showed a shorter bleeding time than when pricked on the heel. Five (5 per cent plus) showed the same bleeding time. However, these variations all fall within the range of the normal. The average bleeding time as determined by a prick from the lip was 1 minute and 30 seconds.

The maximum bleeding time from the lip at the age of 44 days was just half of that determined at birth, 2 minutes and 39 seconds. None of these showing long bleeding time at twenty-four hours of age returned for the repeat test so that no comparison can be made here.

The maximum coagulation time from the heel at birth was 5 minutes and 45 seconds. One other child reached a record of 5 minutes and 30 seconds. Five ranged between 4 minutes, 15 seconds and 4 minutes, 45 seconds. Only two of the latter had shown long bleeding times from the heel. The coagulation time dropped as low as 45 seconds in one instance. The average was 2 minutes and 33 seconds.

The maximum coagulation time from the lip at birth was 5 minutes and occurred in only one baby. Three others ranged between 4 minutes and 4 minutes, 20 seconds. A comparison of these figures with those from a prick in the heel showed there was a smaller number with long (i.e., 4 and 5 minutes) coagulation time from a prick in the lip than from a prick in the heel.

CONCLUSIONS

1. The average bleeding time at birth is between one and two minutes, according to the technic outlined above.
2. The average coagulation time at birth is between two and three minutes, according to the technic outlined above.
3. There is very little difference between male and female babies and between the blood taken from the skin and mucous membranes.
4. With the exception of isolated cases, there is no appreciable change in the coagulation time and bleeding time of newborns in the first six weeks without medication of any kind.
5. Although in certain cases we have been able to reduce the bleeding and coagulation time to normal for from ten to fifteen minutes with the use of theelin subcutaneously, the results are not uniform.
6. We have not been able to reduce the bleeding and coagulation time in the newborn uniformly with the use of gelatin solution.

REPUBLIC BUILDING

Das, Sir Kedarnath: Twin Pregnancy (A Demographic and Ethnic Study), J. Obst. & Gynaec. Brit. Emp. 41: 227, 1934.

The official birth statistics of nine countries, with a total of slightly over 186 million births, give a proportion of 1:90, while hospital statistics of 15 countries, with a total of 2,343,529 labors, give a proportion of 1:79. The frequency of twins in white races in the United States of America is 1:88, while that of colored races is 1:67. The proportion of twins in white races in Indian hospitals is 1:95, while that of the dark races is 1:59. Hence twins are more frequent in colored than in white races. Climate does not seem to have any influence on the frequency of twins. No definite conclusion may be arrived at regarding periodic variation.

WILLIAM F. MENGERT.

GRANULOSA CELL TUMOR OF THE OVARY IN A CHILD WITH PRECOCITY*

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WE HAVE had under our observation since 1931 a child who at the age of seven years became precociously developed sexually as a result of a rapidly growing granulosa cell tumor of the ovary.

I. C., aged seven, was admitted to Jefferson Medical College Hospital on June 2, 1931. She was a full-term baby, delivered by forceps. Her early development was very slow, both physical and mental. She had had rickets and did not walk until two and a half years of age. Four months before hospitalization menses began, lasted three days, and recurred every twenty-eight days. The patient began to menstruate on the day of admission. About the time the first menses occurred, the mother noted that the breasts had enlarged considerably, while the child complained of local soreness. At about that time the mother also noticed that growth of pubic and axillary hair had begun. Two weeks before admission the mother observed enlargement of the child's abdomen. The mother states that in the last four months the child had increased in size generally.

One other younger child in the family is perfectly normal.

The patient's general attitude and mentality was subnormal in type. The head was of the large square type, with prominent forehead. The breasts were enlarged as those of a child at puberty. A heavy growth of pubic hair was present (Fig. 1). The abdomen was distended and a large nodular mass was felt in the lower portion.

The blood count showed a hemoglobin of 80 per cent; red blood cells, 4,150,000; white blood cells, 17,500. The platelet count was 432,000; the bleeding time, four minutes. The Wassermann test was negative. Blood calcium, 9.28 mg.; blood phosphorus, 4.8 mg.; blood sugar, 74 mg. per 100 c.c.

The estrin pregnancy test was positive two days prior to operation, while the Aschheim-Zondek test was negative.

Roentgen examination of the abdomen revealed the lower half of the abdomen uniformly denser than normal, with the colon displaced upward. This density had the appearance of being caused by a soft tissue mass. The kidneys seemed of average size and position, with no evidence of calculus in the urinary tract and no pathologic change in the vertebrae or bones of the pelvis.

The sella turcica was within normal limits, the clinoids both well formed. There was no definite evidence of intracranial disease but pronounced evidence of "ripening" of the skeleton in the epiphyses at the lower end of each humerus and the upper end of each radius. The epiphyses in the upper and lower end of each femur were united with the diaphyses of the respective bones, seven to ten years earlier than is usual (Fig. 2).

The patient was operated upon June 4, 1931, and a large tumor of the left ovary was removed. The right ovary appeared to be normal and was left in situ. The child made an uneventful recovery and was discharged on June 25, 1931. The estrin pregnancy test on the seventh postoperative day was negative.

*Read at the meeting of the Obstetrical Society of Philadelphia, March 1, 1934.

PATHOLOGIC REPORT (DR. B. L. CRAWFORD)

The specimen consisted of a somewhat rounded, but slightly flattened mass which measured 18 by 14 by 8 cm., and weighed 1,250 gm. (Fig. 3). The external surface was fairly smooth but bossed, and on one surface a portion of the fallopian tube was attached. No evidence of the remains of ovarian tissue was observed. The mass seemed to be definitely encapsulated. Numerous blood vessels could be seen beneath the surface. On section, the tumor was composed of a more or less homogeneous gray tissue which was fairly soft but tough. The mass was divided into distinct nodules, but there seemed to be a fusion of the tissue forming the nodules

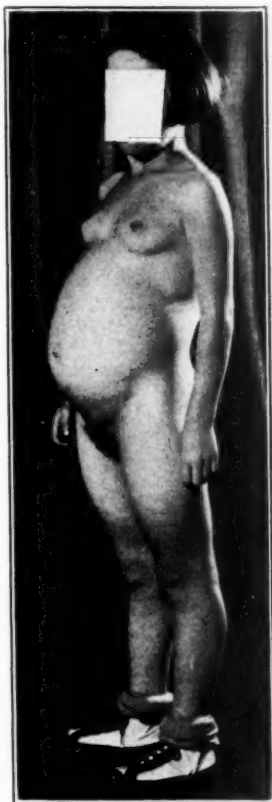


Fig. 1.—Child aged seven with precocious sexual development as a result of recurrent granulosa cell tumor of the ovary. (Note the hypertrophic breasts and marked growth of pubic hair.)

and the fibrous septa and capsule. The tumor tissue varied somewhat in consistency and color, and some areas seemed to have undergone degeneration with the formation of fluid. There were numerous blood vessels and small blood channels present, but no definite cyst formation was observed.

Microscopic examination of different sections from the tumor mass revealed that it was composed of rather large polyhedral cells with clear cytoplasm and deeply stained but relatively small nuclei (Fig. 4). In places these cells were loosely arranged in a fibrous tissue stroma. In other places they formed small solid clumps and numerous acini and small cysts. In the latter areas there was a close resemblance to the small follicular cyst. Several sections were examined from various

portions of the neoplasm and the type of cells was found to be fairly uniform throughout, and the arrangement only varied in that in places the cells formed small acini and cysts. No other type of epithelium or other structures to indicate a definite teratoma were observed. The fibrous tissue stroma was rather abundant in areas and formed distinct trabeculae throughout and was continuous with a definite fibrous capsule.

No marked irregularity of the cells, such as a variation in the size and shape, or mitosis of the nuclei, was observed to indicate a high degree of malignancy. From the predominating type of cell and the arrangement to form small cysts and acini, the neoplasm was considered to be one of the granulosa cell type.

Diagnosis.—Granulosa cell tumor of the ovary.

After the operation, June 6, 1931, the child did not menstruate for eighteen months or until January, 1933, when the menses unexpectedly returned and lasted two days. At that time the child began to complain of pain in the right lower portion of the abdomen which began to swell. Menses recurred every twenty-eight days for the following three months until she was readmitted to the hospital on April 15, 1933. A large abdominal mass, freely movable, was felt in the right side of the abdomen.

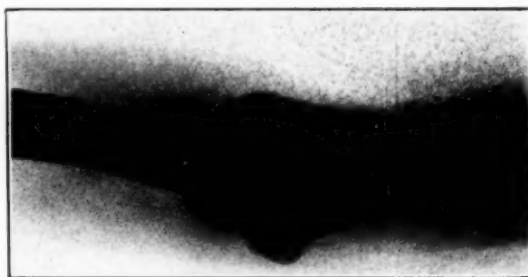


Fig. 2.—Roentgenograph of upper extremity showing precocious "ripening" of the epiphyses.

On the day of readmission the estrin pregnancy test was definitely positive, also the Aschheim-Zondek test. The estrin blood test (Frank-Goldberger) was positive. Likewise, the anterior pituitary sex hormone test of the blood was weakly positive (Aschheim-Zondek reaction).

ROENTGEN STUDIES

This examination revealed a large mass in the right half of the abdomen which displaced the hepatic flexure upward. There was no evidence of metastasis to any of the bones of either shoulder girdle, to the lungs or mediastinum, to the skull, to any of the thoracic or lumbar vertebrae, to the bones of the pelvis, or to the femora, radii or ulnae.

On April 19, 1933, laparotomy was performed, and a large tumor identical with the one previously removed was found completely involving the right ovary. A subtotal hysterectomy and salpingo-oophorectomy were performed.

The child made a satisfactory recovery. On the fourteenth day (postoperative), the Aschheim-Zondek and estrin tests of the urine were negative. Six months later, October, 1933, no regression of the mammary development had as yet occurred, and the pubic and axillary hair were still present in abundance. At that time, the estrin test of the urine was negative. The anterior pituitary sex hormone test of the blood was weakly positive (Reaction 1). The estrin blood test was negative.

PATHOLOGIC REPORT (DR. B. L. CRAWFORD)

The second growth consisted of a somewhat irregularly shaped, rounded and flattened, tumor mass which weighed 1,460 gm. and measured 21 by 18.5 by 6 cm. In general, this tumor closely resembled the one previously reported upon. The sections of the previous tumor were reviewed and the histologic structure of the two growths was found to be essentially the same. In the more recent tumor, more of the tissue



Fig. 3.—Granulosa cell tumor of ovary in a child causing sexual precocity.

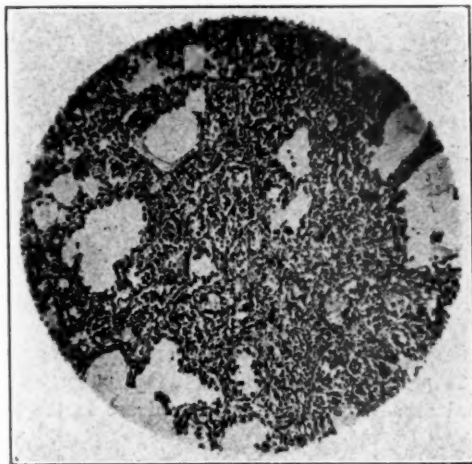


Fig. 4.—Photomicrograph (low power) of granulosa cell tumor of the ovary in a child seven years of age.

seemed to be composed of edematous fibrous stroma than in the first specimen. The tumor cells were identical with those in the first specimen, closely resembling granulosa cells.

Sections from the uterus were also examined and showed an endometrium which was mature and in the interval stage.

Diagnosis.—Granulosa cell carcinoma of the ovary.

It is not unlikely that a reexamination of the specimens of ovarian neoplasms encountered in cases of sexual precocity would disclose a large proportion of granulosa cell tumors. To date, 7 cases of granulosa cell tumor of the ovary, all associated with the clinical syndrome of precocious puberty, have been recorded. Several have been described in duplicate by different authors (Table I). These cases together with our case make a total of 8. Removal of the tumors results in comparative restitution of physical form and cessation of menstruation.

TABLE I. GRANULOSA CELL TUMORS OF OVARY IN CHILDREN (OPERATIVE CASES)

NO.	AUTHORS	YEAR	AGE IN YEARS	SYMPTOMS	OUTCOME
1	Blau	1926	5	Abdominal pain;	Well after one
	Sternberg			vaginal bleeding	year
2	Pahl	1931	9	Sexual precocity;	Recovery
				menstruation	
3	Rummeld	1931	5	Sexual precocity*;	Well after ten
	Habbe			menstrual bleeding	years
4	Meyer	1931	11½	Sexual precocity;	Well after ten
				vaginal bleeding	years
5	Novak	1933	4	Sexual precocity	Well after two
					years
6	Novak	1933	5	Abdominal pain;	Unknown
				sexual precocity	
7	Novak	1933	6	Sexual precocity;	Well after one
				vaginal bleeding	year
8	Bland			Sexual precocity;	Well after six
	Goldstein	1934	7	regular menstruation*	months

*Bilateral (recurrence). Others unilateral.

SUMMARY

1. A case of precocious sexual development in a child, seven years old, due to bilateral granulosa cell tumors of the ovary is reported.
2. So far as we have been able to determine from a perusal of the literature, this is the first case studied from the aspect of hormonology in this country.

1621 SPRUCE STREET

1715 SPRUCE STREET

DISCUSSION

DR. LEWIS C. SCHEFFEY.—Dr. Goldstein quoted a review of sarcoma of the ovary in children and young girls that we made some years ago. An interesting point brought out was that prior to puberty sarcoma of the ovary showed sexual precocity in about 25 per cent of the cases. After puberty there was a tendency (25 per cent) toward sexual hypofunction in contrast to the precocity noted prior to puberty.

KRUKENBERG TUMOR OF THE OVARIES

ANDREA SACCONI, M.D., AND SARAH GORDON, M.D., NEW YORK, N. Y.

(From the Pathological Department, Metropolitan Hospital)

MRS. S. F., aged thirty-two years, a telephone operator, was admitted June 22, 1932. For the past few years she suffered from pain in the epigastrium immediately following meals and lasting about thirty minutes. The severity of the pain varied directly with the quantity of food ingested. Belching and nausea were present with frequent association of vomiting. The patient was greatly relieved by taking small amounts of food frequently. Constipation was constant. Lost 10 pounds in past year. The past history was irrelevant except for ventral suspension of uterus six years ago. Two normal full-term pregnancies. Physical examination was essentially negative, except for marked tenderness and voluntary spasm over the gallbladder region. No palpable masses. The fundus was enlarged and fixed anteriorly with firm masses palpable anteriorly and to the right through the vaginal wall; small firm nodule palpable in posterior fornix. Clinical diagnosis: fibroid uterus.

Laparotomy was performed on June 24, 1932. A considerable amount of straw-colored fluid was removed and a large irregular omental mass presented into the wound (biopsy taken), extending upward, covering the stomach and involving the lower edge of the liver and gallbladder. Ovaries were enlarged, the tube appeared congested, and the uterus presented no abnormal findings. The operative diagnosis was abdominal carcinomatosis.

The biopsy specimen represented a metastatic carcinoma of a lymph node with destruction of the lymphoid tissue and of replacement fibrosis. In one small place there were some atypical glands lined by cells with hyperchromatic nuclei and acidophilic protoplasm. Many mitotic figures were present.

Following the operation, the patient showed enlargement of the abdomen, complained of abdominal pain, was nauseated, and vomited for several days. Vomitus showed mucus and blood. Stool was black. It was necessary to do repeated abdominal paracentesis to relieve patient (over 200 ounces removed). Patient died Sept. 7, 1932.

Autopsy Findings.—The chest organs were normal. The peritoneal cavity contained a large amount of clear, yellowish fluid. The liver, spleen, kidneys, and adrenals showed slight congestion.

The stomach was enlarged and at the pylorus a large crateriform ulceration was seen infiltrating the wall and extending into the hepatic chain of lymph nodes. The peritoneum was markedly thickened. The entire intestines and omentum were matted together into a large mass. The ovaries were enlarged and irregular in shape. The left ovary was 8 cm. in diameter, and the right was 5 cm. The external surface of both ovaries was pale gray, nodular but smooth. The cut surface was white, firm, and homogeneous in consistency, except for a few very small cystic areas present here and there.

Microscopic Examination.—Ulcer of stomach: There was a diffuse growth of polyhedral cells with hyperchromatic nuclei, showing in some areas columnar arrangement and in others formation of small alveoli, which were in some parts elongated and the underlying stroma was thickened. The stroma showed marked

desmoplastic changes and some of the cells of the stroma showed large and even monstrous nuclei. The wall of the stomach was thickened; some of the lymph nodes

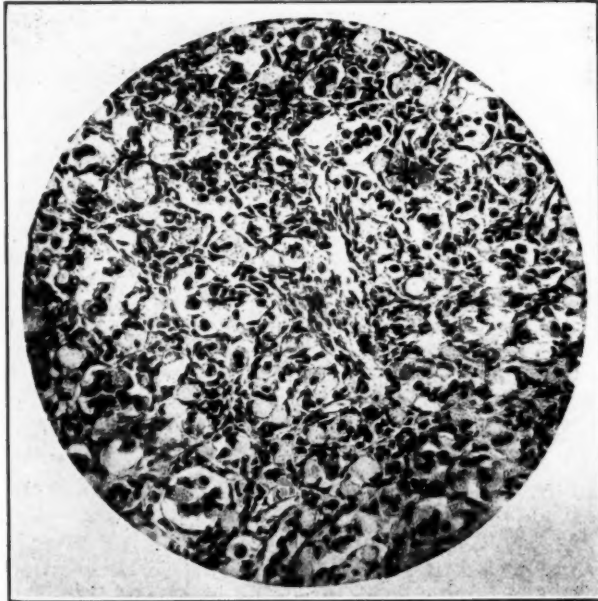


Fig. 1.—Carcinoma of the ovary with signet-ring cells.

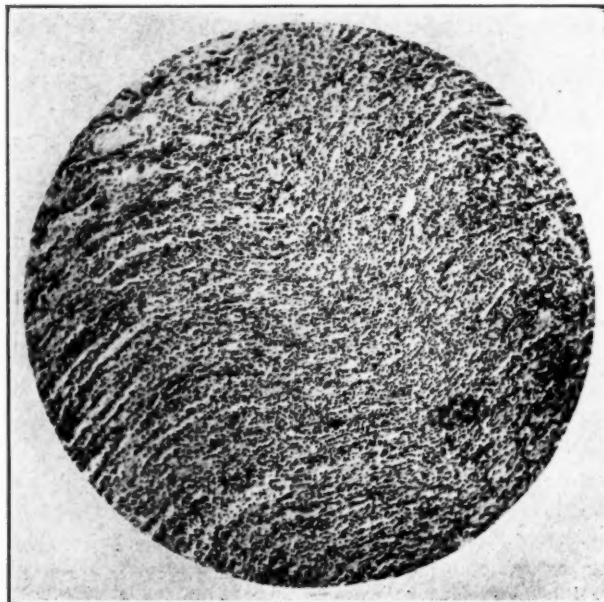


Fig. 2.—Carcinoma of the stomach (diffuse type). (Ewing's classification.)

of the greater curvature were imbedded in the neoplastic tissue. This was formed by strands of epithelial cells with anaplastic appearance and many with mitotic figures.

Peritoneal nodes showed metastasis of the same type of cells as above, with more or less atypical glandular or alveolar formation.

Ovaries: There was an extensive growth of large rounded cells with eccentric nuclei (signet-ring cells) with a very small amount of connective tissue stroma. In some areas the stroma had a myxomatous appearance and in others were present spindle cells of the fibroblastic type. These areas were irregularly distributed.

Pathologic Diagnosis: Diffuse infiltrating carcinoma of stomach, metastatic in both ovaries (Krukenberg tumor).

SUMMARY

A case of Krukenberg tumor of the ovaries is presented with characteristic gross appearance and microscopic structure. From the clinical history, gross pathology, and microscopic findings, we believe that the tumor originated in the stomach, infiltrated the peritoneum, and was transmitted to the ovaries by implantation of wandering tumor cells.

AN ENORMOUS OVARIAN CYST

W. F. GEMMILL, M.D., F.A.C.S., YORK, PA.

(From the York Hospital)

THE following case is reported as being one of the largest ovarian cysts recorded in recent literature.

Mrs. E. Y., aged forty-six, weight 287 pounds, para iii, was seen in consultation May 18, 1932, at her rural home. She had never been seriously ill, and there had been no noticeable enlargement of the abdomen until two or three years prior to the consultation. She had not been able to lie down for the last six months on account of the huge abdomen, which, when she sat, rested on the flexed thighs to within six inches of the knee joints.

The family physician had inserted a trocar into the midline of the lower abdomen and placed a cannula in situ. A clear fluid dripped constantly through the cannula into a large bucket, and in this way $14\frac{1}{2}$ quarts, that is, 29 pounds, of fluid were removed. This later was proved to be free fluid from the general abdominal cavity as shown in Fig. 1. The removal of this fluid somewhat relieved her respiratory distress.

The patient was admitted to the surgical service of the York Hospital, May 20, 1932.

The physical examination did not show anything remarkable except the huge abdomen, which was enormously distended and extremely tense. There was no abdominal tympany or enlarged superficial abdominal vessels present; palpation and percussion gave one the impression of a huge spherical solid in the abdomen. The temperature ranged from 99° F. to 100° F. Several examinations of the urine showed a trace of albumin, a few pus cells and many hyaline and granular casts. The phenolsulphonephthalein test showed 15 per cent elimination of the dye in the first hour. Urea nitrogen was 19 mg. No gonorrheal organisms were found in the cervical smears, and the Wassermann test of the blood did not demonstrate any syphilis. The red blood cells numbered 4,040,000 and were normal in appearance.

The hemoglobin was 75 per cent; leucocytes numbered 6,400; and the polymorphonuclears were 68 per cent. Coagulation time and bleeding time were, respectively, five minutes, and two and one-half minutes. The fragility test was normal.

On May 21, 1932, the patient was taken to the operating room, and under local anesthesia an incision about $1\frac{1}{2}$ inches long was made in the midline; when the abdomen was opened, the white glistening wall of the huge cyst appeared. The finger was insinuated between the cyst wall and the peritoneum of the anterior abdominal wall. These two structures were intimately adherent one to the other, and separation caused considerable oozing. A trocar, later followed by a rubber tube, was then inserted through the cyst wall, and 52 quarts (104 pounds) of reddish brown thin fluid was gradually removed over a period of several hours. During the next six days, nine more quarts were removed.

On May 27, as the condition of the patient was excellent, an operation for removal of the cyst was performed under light gas anesthesia. The site of the

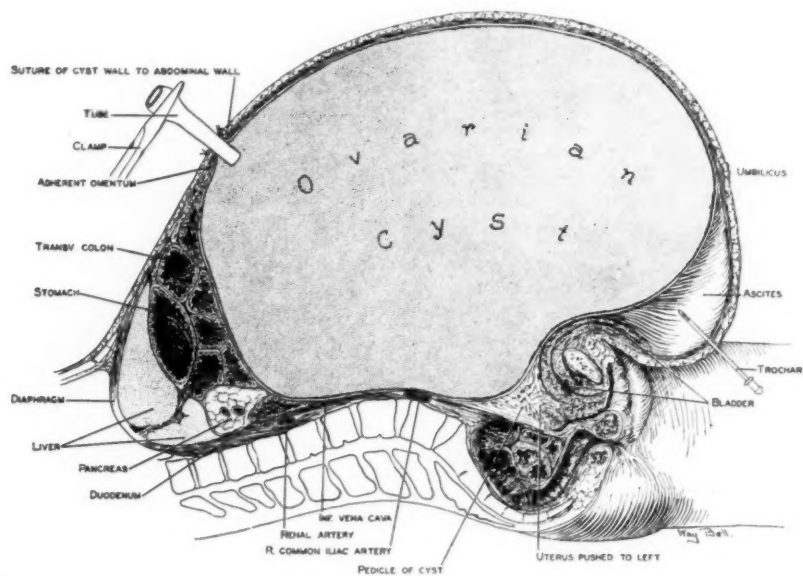


Fig. 1.—Huge ovarian cyst.

former tapping was covered with collodion and a new incision made in the midline nearer the pubes. The large cyst was found to be much shrunken and was easily stripped from its several weak attachments to the abdominal wall without bleeding. The omentum was attached to the extreme upper part of the cyst wall, but the intestines were nowhere adherent. The entire mass seemed to spring from the whole right side of a small atrophic uterus and on account of the marked thickening in the region of the broad ligaments could not be removed without sacrificing the uterus; accordingly a supravaginal hysterectomy was performed, and 3 more quarts of fluid were removed. The entire mass when lying collapsed on a flat surface measured 17 inches in diameter and it weighed 16 pounds. The walls in its shrunken condition varied from one-fourth to one-half inch in thickness. There were no daughter cysts. The entire amount of fluid removed from the abdomen and cyst was 157 pounds, 29 pounds being taken from the general peritoneal cavity. The fluid contents of the cyst weighed 128 pounds. The contents of the cyst together with the cyst wall, pedicle, and atrophic uterus weighed 144 pounds.

The gallbladder was full of large gallstones. The appendix appeared normal; neither of these organs was disturbed.

Three days following the operation the patient's condition was very satisfactory, but on the fourth postoperative day she developed a suppurative left parotitis, which necessitated incision and drainage. Following this infection the patient became progressively more anemic, until one month after her admission to the hospital her red blood cells were 1,990,000, and hemoglobin was 24 per cent.

On June 24, 1932, the patient developed a mild phlebitis of the left leg. There was however no elevation of the temperature above normal and no definite evidence of visceral hemorrhage. On account of the low cell count and hemoglobin, 580 c.c. of blood were given by the direct transfusion method. Later the red blood cell count was 2,500,000 and hemoglobin was 38 per cent, occult blood was found both in the urine and in the stool.

Finally thirty-seven days after admission to the hospital, the patient had a severe intestinal hemorrhage; she did not recover from this.

In retrospect it would seem that infection and delayed hemorrhage turned the scale against recovery. In all probabilities not enough time had elapsed for immunization of the peritoneal cavity against the possible infection that might have been carried by the cannula inserted in surroundings that were not ideal.

The possibility of delayed hemorrhage demands that decompression of such a huge cyst should be done very gradually, possibly a matter of weeks instead of days in order to avoid disaster.

135 EAST MARKET STREET

A PRACTICAL OBSTETRIC MANIKIN*

J. BAY JACOBS, M.D., F.A.C.S., WASHINGTON, D. C.

TO FACILITATE the teaching of the mechanisms of labor in vertex and face presentations, the author has devised the metal manikin herewith shown.

It is a reduplication of a normal female pelvis, which may be readily fastened to any table top; and when so attached, the inclinations of the plane of the inlet and symphysis pubis correspond to those of the patient in modified lithotomy position, which she assumes during normal labor.

In Fig. 1, "A" shows the manner in which the pelvis may be secured to the table top. It may be permanently attached by means of three heavy screws entering through the top of the bracket, or temporarily fastened by a large thumb-screw on the inferior surface of the bracket. One who finds it desirable to carry the manikin from place to place, or who for other reasons desires to remove the model when not in use, would naturally prefer the latter type.

The original model of the skull was carefully carved by hand, and for teaching purposes it possesses many points of superiority over the skull of the normal fetus. The head of the expensive chamois doll that is routinely used in medical schools, is a poor representation of a theoretically perfect fetal skull.

Although the diameters of the pelvis are normal, those of the skull have been slightly reduced in proportion to each other in order to permit flexion, extension, and internal rotation to occur in the cavity of the true pelvis. The forces in-

*Received for publication, January 8, 1934.

herent in the birth object are clearly demonstrated in this skull. The sutures and fontanels are not only imbedded into the metal but are painted black, making them visible at a great distance. A top view of this head shows the relationship in size of the bitemporal and biparietal diameters. The parietal eminences are prominent. The handle representing the neck shows clearly the existence and enables demonstration of the function of the two-arm lever, encouraging flexion when the head encounters resistance. The junction of the head and neck permit of complete flexion and extension.

The prominent ischial spines enable one to demonstrate without obstruction of the view when engagement has occurred. In teaching operative deliveries, the spines will serve to differentiate between high forceps, midforceps, and low forceps applications.

In considering the mechanism of persistent occiput posterior, we recognize deflection as a causative factor. For when the head is moderately extended, the sinciput comes in contact with the pelvic floor and rotates anteriorly, conveying the occiput into the hollow of the sacrum. To demonstrate this feature with a

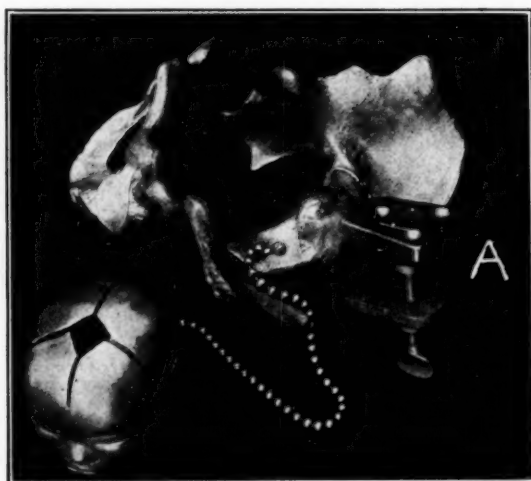


Fig. 1.

chamois doll or a normal fetus, one must extend the head to a brow or almost a face presentation. With the skull shown, moderate deflection will bring the sinciput lower than the occiput, enabling one to demonstrate intelligently the mechanism of occiput posterior.

To aid in the demonstration of the mechanism of labor in brow presentation, the malar bones were made unusually prominent. Face presentations are readily demonstrable.

Some teachers prefer to have the skull attached to the manikin by a chain so that it will not be lost; this is desirable where the phantom is permanently attached. Others may prefer to eliminate the chain.

A metal pan (Fig. 2) properly shaped to support a dead fetus is readily attached to the pelvis. This is an aid in the demonstration of operative deliveries. By means of two thumb screws the anterior margin of the pan is secured to the anterior inferior iliac spines. The posterior border of the pan is supported suitably by an adjustable bracket. Elevation of the posterior border simulates a uterine contraction, the long axis of the fetus is made to approach the axis of the superior strait. Diminishing the heights of the posterior support, resembles uterine relaxation.

It is noticed that elevation of the posterior border of the pan causes the fetal skull to engage more readily. And when the occiput is directed anteriorly, there is not only a marked tendency toward engagement, but also a definite increase in the rate of descent. This corroborates the clinical observations regarding the rapid descent of the occiput anterior as compared to the occiput posterior. It also calls to our attention the desirability of so altering the inclination of the inlet, as to cause the forces of expulsion to approach the perpendicular to the superior strait, a factor to which on several occasions, I have directed attention.¹

The author believes that this phantom possesses many advantages over other teaching models.

1. The appliance is inexpensive and indestructible. It need not be handled with care.
2. This manikin, with skull attached, weighs only 5 pounds.
3. There are no leather or rubber parts which perish with age and are expensive to replace.



Fig. 2.

4. The accessory parts that may add beauty, but obstruct view and teaching efficiency, are omitted.

5. The head of a chamois doll is a poor example of a theoretically accurate fetal skull.

6. In demonstrating face presentations with a chamois doll, the neck becomes torn from the chest.

7. Chamois dolls are expensive and their period of usefulness limited.

8. The structure of the bony pelvis, as well as the fetal skull, and the forces inherent in the birth canal and birth object, as related to the mechanisms of labor, may be demonstrated to large classes if so desired.

9. By means of an inexpensive, adjustable metal pan the manikin is readily adapted for the demonstration of operative deliveries with a dead fetus.

10. The effect of uterine contraction and relaxation may be simulated by increasing or decreasing the inclination of the fetal supporting pan.

11. One readily observes why the head in occiput anterior engages and descends more readily than in occiput posterior.

At Georgetown University where the model has been used for two years, it is

found convenient and inexpensive to have one of these manikins permanently attached in each of the six obstetric quiz rooms.

A manikin of this type may prove of value, not only in teaching classes of students and nurses, but also for use in the delivery room, where the individual doctor may study the mechanism of the case with which he is particularly concerned.

REFERENCE

- (1) *Jacobs, J. Bay*: South. M. J. 22: 321, 1929.

WASHINGTON MEDICAL BUILDING

A COMBINED INLET AND OUTLET PELVIMETER

SAMUEL HANSON, A.M., M.D., F.A.C.S., STOCKTON, CALIF.

(From the San Joaquin General Hospital)

THE most important dimensions of the pelvis are the true conjugate, and the biischial and posterior sagittal diameters. A simple instrument for the accurate measurement of all three of these diameters is very much to be desired. The purpose of the present communication is to present an instrument designed to fill this need.

The pelvimeter consists of two sliding detachable blades (Figs. 1, *A* and *B*) and a series of six gauges (Fig. 1, *C*).

An open thimble is attached to one end of the lower blade to admit the tip of the middle finger. In its middle third the blade is curved spirally to fit evenly to the dorsum of the middle finger, and to the dorsoradial side of the index finger. A thumb screw and a slot are provided near the opposite end to receive the upper blade.

The upper blade consists of a straight bar with a vertical arm of 2.5 cm. in height at one end, and a ring to fit the tip of the index finger at the opposite end. In its middle third the blade has a slot to admit the thumb screw of the other blade. The blade is calibrated in centimeters, the graduations representing diagonal distances from the free border of the ring to the points marked on the blade. The instrument is so constructed that the same markings also represent the diagonal distances from the free end of the vertical arm on the one blade, to the horizontal diameter of the thimble on the other blade. Both the true conjugate and the posterior sagittal diameter can therefore be read off on the same scale.

For the actual measurement of the true conjugate (Fig. 2) the tip of the middle finger is passed through the thimble, and the blade resting on the radial side of the hand is introduced into the vagina. The upper blade, held vertically, is introduced under the pubic arch, and is dropped to the horizontal position as it enters the vagina. The blades are locked, and the thimble is guided with the middle finger, toward the promontory of the sacrum. With the tip of the finger resting against the promontory, the instrument is raised against the pubic arch, and at the same time the lower blade is partly dislodged from the finger tip until the thimble strikes the promontory. Traction is simultaneously made on the upper blade, and a reading is quickly taken on the scale as soon as definite resistance is felt at all three points, namely, at the promontory, at the pubic arch, and at the upper and inner border of the pubis. The value obtained represents in centimeters, the length of

the true conjugate. With a little experience the necessary dexterity can be readily acquired, so that measurements can be taken quickly, and without inflicting intolerable pain, even in primiparas.

The width of the biischial diameter is determined by selecting one of the gauges

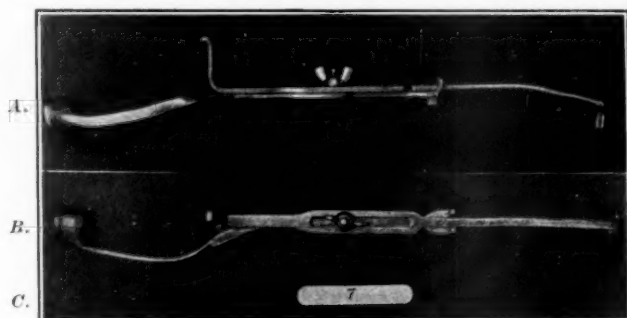


Fig. 1.—A, lateral view of pelvimeter. A broad ring (a thimble open at both ends) is attached obliquely to the free end of the lower blade.

Upper blade shows a vertical arm of 2.5 cm. in height at one end, and a ring at the opposite end.

B, anterior view showing spiral curve in lower blade, thumb screw, and slot.

Slot is shown in upper blade; also scale with graduations to read at the slot of the lower blade.

C, gauge measuring 7.0 cm. in length.

The other sizes are 6.0, 6.5, 7.5, 8.0, and 8.5 cm.

These gauges are attachable to the pelvimeter proper, for convenience in handling when the instrument is not in use.



Fig. 2.—Direct internal measurement of the true conjugate.

The tip of the middle finger together with the thimble is held against the promontory; the free end of the vertical arm is pressed against the upper and inner border of the pubes; the pelvimeter is raised against the pubic arch.

to fit between the ischial tuberosities, as recommended by DeLee.¹ From 1.0 to 1.5 cm. is added for the thickness of the overlying skin and subcutaneous fat. An accurate measurement of both the biischial and posterior sagittal diameters becomes

necessary only when the distance between the tuberosities is found to be too narrow to admit the largest gauge (the one measuring 8.5 cm.).

The method for the measurement of the posterior sagittal diameter is exactly the same as that already described in a previous communication.² For the sake of completeness the method is again given, and a new illustration is added (Fig. 3). The procedure is as follows:

A rectal examination is made, and the sacrococcygeal joint is identified by a combined internal and external manipulation of the coccyx and tip of the sacrum. The tip of the index finger is passed into the ring of the pelvimeter, and the blade resting on the dorsum of the finger is introduced into the rectum. The sacrococcygeal joint is identified as before, and the ring is placed and steadied against the tip of the sacrum by gentle pressure with the tip of the finger. The gauge already selected is accurately adjusted between the ischial tuberosities with the

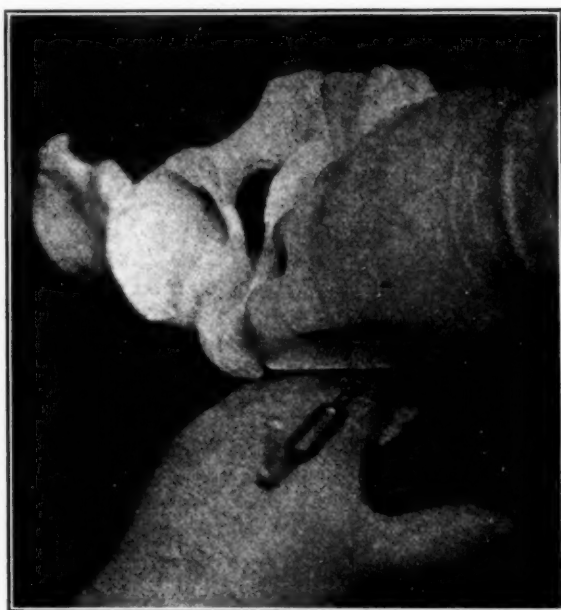


Fig. 3.—Direct internal measurement of the posterior sagittal diameter. Lower blade introduced into rectum, and ring held against sacrococcygeal joint; blade raised against gauge which is adjusted between the ischial tuberosities.

thumb and index finger of the other hand. The blade of the pelvimeter is then raised against the midpoint of the gauge, and a reading is made on the scale. The value obtained represents accurately in centimeters, the length of the posterior sagittal diameter. No correction is necessary since the measurement is taken internally.

The instrument satisfies the practical requirements of simplicity and precision. The use of one instrument for the measurement of the three most important diameters of the pelvis is another distinct practical advantage.

The pelvimeter is made by George P. Pilling and Sons Company, Philadelphia, Pa.

REFERENCES

- (1) *DeLee, J. B.*: Principles and Practice of Obstetrics, p. 261, Philadelphia, 1928, W. B. Saunders Company.
- (2) *Hanson, Samuel*: AM. J. OBST. & GYNEC. 26: 736, 1933.

1009 MEDICO-DENTAL BUILDING

POSTPARTUM PARALYSIS, WITH REPORT OF AN UNUSUAL CASE*

ABE CLINE, M.D., DAYTON, OHIO

PARALYSIS is an uncommon complication of pregnancy, but its occurrence is distressing to the patient and her family, and disturbing to the obstetrician. Obstetric textbooks have little to say on the subject.

The case I am presenting, in which the cord itself is the seat of injury or disease, falls in none of the reported categories and its unusualness merits inclusion in the literature.

Mrs. S. J., aged thirty-one, para ii, first reported Oct. 29, 1932, complaining of extreme fatigue, some pain in right iliac fossa and a feeling of melancholy. Blood pressure 100/75. Small doses of thyroid extract cleared up symptoms. The only other complaint during pregnancy was indigestion which responded to dilute hydrochloric acid. Previous pregnancy and labor were normal; delivery spontaneous. No complications.

Family history negative except brother has some deformities of extremities resulting from Still's disease in childhood. Husband and baby both robust.

Patient's past history entirely negative. Normal weight 140 pounds; gained about sixteen pounds during pregnancy. Blood pressure never higher than 120/75.

Physical examination showed a robust young woman; no abnormalities. Pelvic measurements ample. Perineal floor intact. Thyroid slightly enlarged. Labor at Good Samaritan Hospital May 19, 1933; membranes ruptured previous to admission. Position O.R.P. First stage two and one-half hours at end of which time pains every two minutes quite severe. At 2:45 dilatation complete; labor very rapid. Head rotated spontaneously, and delivered easily without instruments under nitrous oxide anesthesia at 3:08. Placenta followed shortly. Baby healthy; cried and weighed 7 pounds 14.5 ounces; somewhat smaller than previous baby. No tears; patient in excellent condition. Urine next day showed occasional white and red blood cells and occasional granular and hyaline casts. No albumin. No edema; no eye symptoms. Blood pressure normal. Breast feeding discontinued on account of cracked nipples. Patient had coryza at time of delivery. Temperature reached 99° on second day and 100° on fourth day; dropped next day to normal and remained so. Pulse never over 84. Lochia quite normal throughout. Bowels regular and no pains in legs. Patient was helped into chair on eighth day; no discomfort. Complained of weakness of legs on attempting to walk on the tenth day. Dismissed in wheel chair. Next day nurse reported patient's inability to walk and examination revealed paralysis of both legs.

Neurologic examination by Dr. E. C. Fischbein showed spastic palsy of both legs with loss of sensation, less marked on left; bilateral ankle clonus present; positive Babinski and heightened knee jerks. Dr. Fischbein's diagnosis at that time was thrombosis of anterior spinal artery at the level of the second dorsal vertebra. No sphincter disturbance at any time and no pains.

Subsequent examinations up to six months postpartum showed considerable sensory, but very little motor recovery. Very slight atrophy of right leg, but spasticity had increased.

Comment.—The diagnosis of thrombosis of the anterior spinal artery may be

*Presented at the Clinico-Pathological Conference, Miami Valley Hospital, October 13, 1933.

questioned. Dr. Benedict Olch, internist, and Dr. Roy Arn, neurosurgeon, who examined the patient about four months postpartum believe the pathology to be a transverse myelitis coincident with and not dependent on the pregnancy. In this connection, Williams may be quoted, "Paraplegia of spinal origin occasionally occurs, but, except in rare cases of toxemia, is not directly dependent upon the existence of pregnancy." Cragin mentions paraplegia of pregnancy due to independent spinal lesion. In my case there was no toxemia and no trauma. What influence the mild respiratory infection at time of delivery may have had is entirely conjectural.

Follow-Up Note.—One year later patient shows about 80 per cent recovery and steady improvement. She can walk without help, drives a car, and swims. Treatment included massage, orthopedic appliances and reeducation of muscles.

FIDELITY MEDICAL BUILDING

BICORNATE UTERUS WITH PREGNANCY IN EACH HORN

ARTHUR B. BARRETT, M.D., NASHVILLE, TENN.

(From the Department of Obstetrics and Gynecology, Vanderbilt University Hospital)

A WHITE female, aged thirty years, was admitted to Vanderbilt University Hospital Mar. 31, 1931, with a history of having had a dull intermittent pain in her right lower quadrant for the past eight years, the pain becoming more severe during the past two months and especially during the past two weeks. There had been some morning nausea and vomiting during the past two months but no vomiting for the past four days. She had some tenderness and enlargement of her breasts. Her last menstrual period was Jan. 6-9, 1931, and was of the usual duration and character. Her previous menstrual period, Dec. 10-14, 1930, was normal. There was a slight bloody vaginal discharge on February 1, but no period in March.

Her menstrual periods had always been regular at twenty-eight-day intervals, except during gestation and lactation, and from three to four days' duration. She had had a slight bloody vaginal discharge between periods for the past two years.

The patient had had six pregnancies, the first three of which terminated in miscarriages at about five months. The fourth pregnancy terminated at seven and one-half months with spontaneous delivery, the fifth pregnancy terminated at six months with miscarriage of twins both of which died shortly after birth, and the sixth pregnancy terminated at term. This child, living and well, is five years old.

Four years ago she had an appendectomy because of the right lower quadrant pain. The operation did not relieve her pain.

On admission the patient was not acutely ill. There was nothing unusual except for the abdominal and pelvic findings. There was a soft, nontender mass in each lower quadrant of abdomen which extended into the pelvis. The vaginal outlet was moderately relaxed; cervix had a blue tinge and was soft and multiparous in size. There were two small cervical polyps about the size of a pea. There was also a moderate amount of erosion.

The fundus was not found in the midline. There were bilateral nontender masses both about the size, shape and consistency of a three months pregnant uterus. These masses seemed to be definitely separated except for fusion at the cervix.

Roentgenograms following pneumoperitoneum showed two large soft tissue shadows lying on either side of the lesser pelvis and apparently meeting at the midline. The uterus could not be definitely made out.



Fig. 1.—X-ray picture following pneumoperitoneum showing two oval, soft-tissue shadows lying on either side of the lesser pelvis and meeting at the midline.



Fig. 2.—X-ray picture of abdomen showing skeleton of twin pregnancy. This x-ray picture was taken six weeks after the pneumoperitoneum.

The laboratory findings were not important except that the Aschheim-Zondek test for pregnancy was positive. Wassermann and Kahn negative.

Patient's symptoms of pain subsided during the first twenty-four hours in the hospital, and after ten days she was discharged in good condition.

She returned to out-patient department five months after her last menstrual period (May 12, 1931). At this time examination showed bilateral lower abdominal masses both the size, shape, and consistency of a five months pregnant uterus. One month later these masses had grown to the size of a six months pregnancy. Fetal heart tone was heard in both masses. X-ray pictures showed a twin pregnancy, both with vertex presentation.

Patient continued with her pregnancy until Aug. 1, 1931, when she was again admitted to the hospital because of threatened miscarriage. After nine hours of labor in which both horns of the uterus contracted simultaneously at regular intervals, the head of one fetus was on the perineum. Patient was anesthetized with ether and the first fetus delivered by low forceps without difficulty. Five minutes later the placenta was easily expressed from the left horn. This left horn of the uterus did not contract well, and there was more than usual bleeding. For this reason the delivery of the fetus in the right horn was done by internal podalic version and extraction. Membranes were ruptured artificially at time of version. Placenta was expressed five minutes after delivery. Following this, both horns of the uterus contracted well, and there was no unusual amount of bleeding. Both horns at this time could be easily felt as separate bodies.

Postpartum recovery was uneventful. Both infants were premature, one weighing 3 pounds 11 ounces and the other 3 pounds 6 ounces. One infant died four hours after delivery and the other seven days after delivery. Examination three months postpartum revealed a bicornate uterus with complete separation of each horn and a single cervix.

SIMULTANEOUS GANGRENOUS TWISTED OVARIAN CYST AND ACUTE GANGRENOUS APPENDICITIS

LOUIS P. KASMAN, M.D., BROOKLYN, N. Y.

(*From the Koster Clinic, Crown Heights Hospital*)

THIS case is being reported because there is no other similar case recorded either in the Surgeon General's Index or the Cumulative Index Medicus.

A female, aged thirty-six years, was admitted to the hospital on Oct. 12, 1932, complaining of severe pain in the lower abdomen. She had had attacks of colicky pains in the lower abdomen for the past two years, usually before or after her menstrual period. For the past month she noticed a mass in the lower abdomen which became more prominent during an attack. Three days prior to admission she had a severe attack of abdominal cramps which localized in the right lower abdomen and radiated to the back and down the right thigh. Some nausea was present but no vomiting.

The patient was married for fifteen years, had three children living and well, all having been delivered normally. She had a stillbirth thirteen years ago. Her menstrual periods began at thirteen years of age, occurred every twenty-eight days and lasted four days. No dysmenorrhea occurred.

There was no history of any childhood disease and the patient was never ill previously except for a slight cold now and then. The family history was entirely negative.

The physical examination revealed a well-developed, robust, white adult female, lying quietly in bed, but appearing acutely ill. Her face was flushed and she appeared to be suffering from pain. The temperature was 102.2° F., the pulse was 126 per min.; the respirations 26 per min.

The abdomen presented marked tenderness and rigidity of its entire lower half, especially pronounced on the right side. There was a mass palpable about the size of a baby's head in the lower midabdomen. Pressure-release tenderness elicited in the left lower quadrant was referred to the right lower quadrant. The Murphy kidney sign was negative on each side.

A vaginal examination showed a multiparous introitus with a normal cervix pointing in the axis of the vagina. The uterus was slightly enlarged and anteverted, but regular in outline. There was a marked amount of tenderness in the right fornix and culdesac. A mass of the size described above was palpable and appeared to spring from the right side of the uterus.

Blood count showed 4,750,000 red cells; 82 per cent, hemoglobin; white cell count was 17,600 with 86 per cent polymorphonuclears and 14 per cent lymphocytes.

A diagnosis of an ovarian cyst on a twisted pedicle was made, but the right rectus rigidity was so marked that a possibility of an acute appendicitis could not be ignored.

Under spinal anesthesia, a low median abdominal incision was made. On opening the peritoneum a large amount of seropurulent fluid escaped. A large twisted ovarian cyst about the size of a newborn's head was found springing from the right side of the uterus. This was twisted two and a half times in a clockwise manner. There was a thrombosis of the vessels in the pedicle of the cyst and necrosis and gangrene of the cyst wall. Immediately behind this cyst an acute gangrenous appendix was found adherent to the right lateral pelvic wall. The appendix and ovarian cyst were removed in the usual manner; the stump of the appendix being inverted by a purse-string suture and the remainder of the pedicle of the ovarian cyst attached to the right side of the uterus and peritonealized by the round ligaments. A cigaret drain was inserted and the abdomen closed in layers.

Within twenty-four hours the patient appeared more comfortable. The temperature was normal on the fifth postoperative day, and the drain was removed the same day. The sutures were removed on the seventh day and the patient was discharged on the tenth day with the wound well healed.

The specimens showed an acute gangrenous appendicitis and gangrenous simple cyst of ovary.

In the case reported here, it is possible that a chronic inflammation of the appendix over a period of years may have caused the formation of this simple cyst of the right ovary. Subsequently an acute exacerbation of the appendix started and by increased irritability and active peristalsis of the bowel the torsion of the ovarian cyst occurred so that both conditions ensued simultaneously.

Society Transactions

OBSTETRICAL SOCIETY OF PHILADELPHIA

MEETING OF MARCH 1, 1934

The following papers were presented:

Granulosa Cell Tumor of the Ovary in a Child with Precocity. Drs. P. B. Bland and L. Goldstein. (See page 596.)

A Study of 79 Patients Delivered by the Latzko Extraperitoneal Cesarean Section. Dr. H. T. Burns. (See page 552.)

The Effect of the Shape of the Pregnant Uterus on the Mechanism of Labor. Dr. J. M. Laferty. (See page 582.)

Endometrial Findings in Functional Menstrual Disorders. Drs. B. M. Anspach and J. Hoffman. (See page 473.)

The Sedimentation Rate and Schilling Index in Pregnancy. Dr. R. J. Griffin. (See page 532.)

NEW YORK OBSTETRICAL SOCIETY

MEETING OF MARCH 13, 1934

The following papers were presented:

Macrocytic Hyperchromic Anemia in Pregnancy. Dr. W. E. Studdiford. (By invitation.) (For original article see page 539.)

Further Studies on the Pelvic Architecture. Drs. W. E. Caldwell, H. C. Moloy, and D. A. D'Esopo. (For original article see page 482.)

The Problems of the Occipitoposterior Position. Dr. A. H. Bill. (By invitation.)

Department of Book Reviews

CONDUCTED BY ROBERT T. FRANK

Review of New Books

Gynecology and Obstetrics

Volume VI of the Practitioners Library of Medicine and Surgery is devoted to *Obstetrics* (565 pages) and *Gynecology*¹ (280) pages. It is designed for the general practitioner, therefore theory is reduced to the minimum and practice emphasized. The book has been written largely by the younger group of obstetricians and gynecologists, including among others, Brady, Greenhill, Martzloff, Te Linde and Karl Wilson. Musselman is the editor of the volume.

The text is concise, modern, and informative. The illustrations are good, many from standard sources, others prepared for this book. In a book of this type it would have been of value to add numerous diagrams to illustrate the "touch picture" in both obstetrics and gynecology.

—R. T. Frank.

Schiller's monograph on *Granulosa Cell Tumors*² covers this subject from alpha to omega. According to the author, the tumors are derived from the granulosa cell and as a characteristic show transitions between epithelial and connective tissue morphology. About 150 cases are on record. The epithelial portions of the tumor, in spite of their strong resemblance to carcinoma in structure, are clinically benign with very few exceptions.

The experiments of the author on mice, in which he used the prepituitary-like hormone and carcinogenic tars to produce what he considers artificial granulosa cell tumors, are extremely unconvincing.

One of the symptoms fairly characteristic of these tumors when they occur after the menopause, is postmenopausal bleeding which apparently results from the production of estrogenic substance by the tumors.

The monograph will prove of importance to any one interested in gynecologic pathology.

—R. T. Frank.

The third edition of Young's *Textbook on Gynaecology*³ incorporates the recent advances in physiology of the pituitary gland and the reproductive system. New

¹*Obstetrics and Gynecology*. The Practitioners Library of Medicine and Surgery. Vol. VI. Associate editor: Luther K. Musselman, Associate Clinical Professor of Obstetrics and Gynecology, Yale University School of Medicine. D. Appleton-Century Company, New York, 1934.

²*Pathologie und Klinik der Granulosazelltumoren*. Von Dr. Walter Schiller, Zweite Universitäts Frauenklinik in Wien. Mit 129 Abbildungen, 3 farbigen Tafeln und 2 Tabellen. Verlag von Wilhelm Maudrich, Wien, 1934.

³*Textbook of Gynaecology*. By James Young, D.S.O., M.D., etc. Gynaecologist, Royal Infirmary, etc. Edinburgh. Third edition, revised, enlarged and largely rewritten. With 220 illustrations. New York, Macmillan Company, London, 1933.

chapters on Pain, Backache, and the Menopause have been written. The Stockholm technic for radium in cancer of the cervix is given in detail. The section on operative procedure is sketchy and poorly illustrated. Aside from this the text is concise and clear and forms a first class students' manual.

—Philip F. Williams.

This Synopsis of *Obstetrics and Gynecology*⁴ is offered to students as a means of revision for final examinations. The staccato manner of presentation of the two subjects should render it highly useful for this purpose. Some new material on embryology has been added in this edition, while Heyman's method of using radium in cervical carcinoma is an additional section. The subjects are covered concisely but adequately for a quick review or reference. The teaching is for the most part quite similar to American texts.

—Philip F. Williams.

In changing this volume, *The Queen Charlotte's Text-Book of Obstetrics*⁵ from a manual on practical obstetrics to a comprehensive textbook, the authors have included a number of chapters such as embryology, abortion, and insanity which were not in the previous edition. There has been a very thorough revision of some parts of the book, and such advances as the Aschheim-Zondek test and an account of Kielland forceps have been added.

In 1930 the hospital opened an Isolation Block for puerperal infection, and adopted the Ministry of Health morbidity standard of 100.4° for twenty-four hours. Morbid patients have been transferred to this segregated area, and the experiences of the authors in treating the septic patients which have arisen in the hospital, and those which have been accepted from the hospital zone, are given in detail. There is a splendid discussion regarding diagnosis, both bacteriologic and clinical, and a careful estimate of the practical value of a number of lines of treatment of puerperal sepsis. The statistics presented are extremely valuable and it is to be hoped that a continuance of this work will shortly afford definite information regarding septic infections.

In the treatment of toxemia, the lowering of blood pressure by the injection of veratrine is considered an important measure, while conservative obstetric interference is recommended.

Although the authors describe in particular their methods of choice, a recapitulation of other treatments is given to make the book a well-rounded text.

—Philip F. Williams.

The first edition of this book, *Lehrbuch der Operativen Geburtshilfe*,⁶ repeated the main portion of the text on the subject in Halban and Seitz' "Biology and Pathology of Women," with some modifications, in order that the material might be published in a single volume. Since the appearance of the first edition in 1927, there have been many changes in technic, and indications for some procedures have been broadened, particularly in the present use of abdominal cesarean section. In this revision such changes have been incorporated.

⁴*Synopsis of Obstetrics and Gynecology.* By Aleck W. Bourne, Queen Charlotte's Hospital, London. Fifth edition, fully revised, with numerous diagrams. William Wood and Company, Baltimore, 1933.

⁵*The Queen Charlotte's Text-Book of Obstetrics.* By the following members of the hospital: Aleck W. Bourne, Trevor B. Davies, L. Carnac Rivett, L. G. Phillips, C. S. Lane-Roberts, and Leslie H. Williams. Third Edition, with colored plates and 301 text figures. William Wood & Company, Baltimore, 1934.

⁶*Lehrbuch der Operativen Geburtshilfe.* Von Professor Dr. Georg Winter, Universitäts-Frauenklinik in Königsberg, und Professor Dr. Josef Halban, Krankenhaus Wieden in Wien. Zweite, weitgehend umgearbeitete Auflage. Mit 282 zum Teil farbigen Abbildungen im Text, 4 farbigen und 8 schwarzen Tafeln. Verlag von Urban und Schwarzenberg, Berlin und Wien, 1934.

Professor Halban of Vienna has become a joint author of this edition and has written the sections on artificial dilatation of the cervix, episiotomy, the destructive operations upon the fetus and operations of the puerperium. These chapters reflect his experience and thorough knowledge of the subject. The sections written by Benthin and Naujoks show evidence of careful revision. Benthin's chapter on cesarean section is beautifully illustrated. Notwithstanding Hitler's recent pronunciamento on sterilization, there is practically no mention of any procedure to prevent future pregnancy, whether or not it is associated with cesarean section.

There is an ample description of Zweifel's new universal forceps with a discussion of the results of their use in the hands of several observers. An entire section is devoted to the Kielland forceps.

Of particular interest, in view of the discussion in Germany a few years ago regarding the extension of social and eugenic indications for the performance of abortion, is the section on "Interruption of Pregnancy."

The revision and the addition of many new illustrations keeps the book in the forefront of works of this nature.

—Philip F. Williams.

The Italian Society for Obstetrics and Gynecology in issuing this large volume⁷ reviews the status of the specialty in that country. Italy's universities are described briefly and the clinical and teaching facilities for gynecology and obstetrics in each are gone into at considerable length. There are also short biographies of the teaching staffs in the different universities together with lists of their publications. Practically all publications emanating from Italy in recent years are listed, and the development of each clinic as a unit, described. The work should be of great value to those desiring to adopt this field as a specialty, since it lists the available teaching facilities. It probably helps also in keeping the standards high.

—Frank Spielman.

Martius' 250-page monograph on *Obstetric Operations*⁸ is a short, concise, practical compendium for students and general practitioners. Controversial matters, references, and statistics have been purposely omitted, the text being strictly devoted to indications and the technic of procedures. The book fulfills these indications very successfully, particularly as the illustrations are numerous, simple, and well chosen.

—R. T. Frank.

Miscellaneous

Among those who have considerably advanced our information concerning the various possible injuries of the child incident to birth, a prominent place is held by Naujoks who now offers us a short monograph dealing with all the *Birth Injuries of the Child*.⁹ The problem is considered from the viewpoint of the obstetrician. Particularly stressed are the mechanical factors responsible for such traumatizations. Prophylactic measures are developed on the basis of etiology. The writer also discusses the various forms of immediate treatment. Many excellent illustrations add to the value of this little book, which unfortunately does not contain an index.

—Hugo Ehrenfest.

⁷*L'Ostetricia e la Ginecologia in Italia*. By Viana, O., and Voza, F. Issued by the Italian Society of Obstetrics and Gynecology. Georgio Zoja, Milano, 1933.

⁸*Die Geburtshilflichen Operationen*. Von Professor Dr. Heinrich Martius, Universitäts Frauenklinik in Goettingen. Mit 276, zum Teil farbigen Abbildungen. Verlag von Georg Thieme in Leipzig, 1934.

⁹*Die Geburtsverletzungen des Kindes*. Von Professor Dr. Hans Naujoks, Universitäts Frauenklinik in Marburg. Mit 49 Abbildungen. Verlag von Ferdinand Enke in Stuttgart. 1934.

A small monograph, *Die Armlähmungen bei Neugeborenen*,¹⁰ of Kehrer deals exhaustively with a special type of birth injuries, namely the paralyses of the arm. Carefully analysing the different mechanical conditions under which these arm lesions are prone to originate, the author finds ample opportunity to set forth clearly, how in various required manipulations of the arms in the course of birth, accidents can be prevented. The volume contains many instructive illustrations but no index.

—Hugo Ehrenfest.

This small volume, *Recent Advances in Endocrinology*,¹¹ represents a new addition to the well-known Recent Advances Series. It deals with newer information in the field of *endocrinology*. The author, being a biochemist, modestly refuses to even mention his own views in dealing with the clinical aspects of endocrinology and stresses chiefly the biochemic aspects of endocrine function, "The final problem, the elucidation of the precise mechanism of the action of these principles, will require profound and prolonged biochemical and physiological study." Scientific investigators along these lines will find in this volume valuable aid in their work through the carefully selected bibliographic references appended to each chapter.

—Ellen Ehrenfest.

For operations upon the vulva, vagina, perineum, and rectum,¹² the author advocates the more extended use of *epidural anesthesia*. He finds that the method is especially useful in old debilitated patients on whom any general type of anesthesia would be dangerous. The technic described is that of Læwen. Indications and contraindications are thoroughly discussed and an extensive literature appended. From this monograph one is impressed with the efficacy of this type of anesthesia. Illustrations showing the technic would probably have improved the text considerably. However, the material is well presented and nicely handled.

—Frank Spielman.

The author devotes this entire book, *Indicaciones y Tecnicas Quirurgicas por Colpotomia*,¹³ to a consideration of gynecologic operations by the vaginal route. He is to be congratulated upon the great variety of conditions he is able to handle by colpotomy. His case reports, which are liberally distributed throughout, obviously point to the skill which must have been necessary in order to carry out the procedures. Large ovarian cysts, ectopic pregnancies, diseased adnexa, as well as large fibroids have been repeatedly removed with little difficulty, and with apparently no untoward results. The method by which the author performs vaginal hysterectomy (Canac-Marquis) as well as his modification is well presented and illustrated. As is usually the case where one particular phase of surgery is discussed there is a tendency toward overemphasis of the method with a minimum of consideration of the dangers involved. However, in again calling attention to colpotomy as a method of choice in gynecologic surgery the book serves a useful purpose.

—Frank Spielman.

¹⁰*Die Armlähmungen Bei Neugeborenen*. Von Professor Dr. Erwin Kehrer, Universitäts Frauenklinik in Marburg. Mit 20 Abbildungen. Verlag von Ferdinand Enke in Stuttgart, 1934.

¹¹*Recent Advances in Endocrinology*. By A. T. Cameron, Professor of Biochemistry, Faculty of Medicine, University of Manitoba, etc. P. Blakiston's Son & Co. Philadelphia, 1934.

¹²*La Anestesia Epidural en Ginecologia*. Por Dr. Normando Arenas. Buenos Aires, 1932.

¹³*Indicaciones y Tecnicas Quirurgicas por Colpotomia*. Por el Dr. Alberto Chueco, Buenos Aires. La Semana Medica, Imp. 1933.

*Sex Habits*¹⁴ by Buschke and Jacobsohn is a short, well-written guide for the laity. Perhaps the lay reaction to the "intoxication of uncontrol" and the "obliteration of conventional standards" of which the authors speak in the introduction, led them to write this well-planned book.

The anatomy and physiology of the male and female organs, insemination, pregnancy and fetus are described and well illustrated. The chapter on puberty is admirable. Sex impulse in male and female, impotence, sterility and abnormalities are considered. Venereal disease, monogamy, heredity and eugenics are other phases dealt with, briefly, on a high plane as well as sanely.

—R. T. Frank.

Written by an anonymous French army surgeon, *The Basis of Passional Psychology*¹⁵ is a pseudoscientific assembly of facts and fancies. It does not lend itself to serious review.

—R. T. Frank.

Selected Abstracts

Endocrinology

Tschaikowsky: Experimental Studies of the Effect of Lipoid Folliculin and Pituitrin Upon the Animal Organism. The Origin of Eclampsia, Arch. f. Gynäk. 150: 505, 1932.

Lipoids produced definite degenerative changes when injected into mice. These changes were especially marked in the kidneys, but were also found in the liver, lungs, and endothelium of the vessels. When pituitrin was added to the folliculin, there was a marked incidence of convulsions, many of which proved fatal. The picture was very similar to that of eclampsia, with definite hemorrhages into the parenchymatous organs.

The author concludes that eclampsia is a pluriglandular disturbance, due mainly to an increase in folliculin, which results from hyposecretion from the corpus luteum. The anterior pituitary hormone stimulates corpus luteum secretion. When injected with folliculin and pituitary, the incidence of convulsions in mice was definitely lessened and their severity less marked. The author believes, therefore, that the hormone of the corpus luteum, lutein, has definite therapeutic value in eclampsia.

RALPH A. REIS.

Selye, Colip, and Thomson: On the Effect of the Anterior Pituitary-Like Hormone on the Ovary of the Hypophysectomized Rat, Endocrinology 17: 494, 1933.

In 50 experiments on rats a special cell type has been found to appear in the ovary very soon after removal of the pituitary. The nucleus of this cell is very similar to that of the plasma cell. These cells described as wheel cells are derivatives of the theca cells. In a series of 15 animals the anterior pituitary-like hormone was found to inhibit the appearance of these cells when given immediately after hypophysectomy. When the anterior pituitary-like hormone treatment was begun at a time when the wheel cells had already been formed, it transformed them into

¹⁴*Sex Habits, a Vital Factor in Well-Being.* By Buschke and Jacobsohn. Translated from the German. Emerson Books, Inc., New York.

¹⁵*The Basis of Passional Psychology.* By Jacobus X ***. French Army Surgeon. Privately reissued by American Anthropological Society. New York.

lutein-like cells. The conclusion is drawn that under certain endocrine influences the normal spindle-shaped theca cells may assume either the appearance of the wheel cell or that of a pseudolutein cell.

J. THORNWELL WITHERSPOON.

Hellwig, C. A.: Histologic Changes in the Thyroid Gland of the Rabbit Following Injection of Urine, Arch. Path. 15: 321, 1933.

Friedman recommended the use of female rabbits instead of mice for the biologic pregnancy test. Krjlew and Sternberg reported structural changes in the thyroid gland of the female rabbit following copulation. These changes were characterized by marked enlargement and hyperemia, disappearance of the colloid and increased height of acinar epithelium. In the light of this knowledge, the thyroid glands in those animals showing positive Aschheim-Zondek reactions might also show changes similar to those found following copulation. If this were true, an additional positive sign of pregnancy might be found by examining the thyroid gland of the rabbit after injection of urine.

Hellwig made such a study. Sixty-four thyroid glands were obtained from animals used for the biologic pregnancy reaction.

Hyperplasia of the thyroid gland occurred in rabbits irrespective of the results of the Aschheim-Zondek test. The assumption seems justified that the active substance in the urine is identical with the thyrotropic hormone of the anterior lobe of the hypophysis although different from the active substance present in the urine of pregnant women, viz., prolactin which stimulates the ovaries. Injection of urine into rabbits presents an easy, rapid and almost certain method for studying the histogenesis of thyroid hyperplasia.

W. B. SERBIN.

Louros: Therapy of Dysfunctions of the Ovary and the Anterior Lobe of the Hypophysis, Arch. f. Gynäk. 153: 296, 1933.

It is very difficult to evaluate hormonal therapy in ovarian and hypophyseal dysfunction because so many factors are involved. Observations on 700 patients with ovarian dysfunction have convinced the author that there are certain prerequisites for the success of hormonal therapy. The latter is valueless when pathology exists in either the ovaries or the uterus. Only if the pelvic anatomy is normal should hormonal therapy be tried.

The symptoms due to hypoovarianism yield promptly to this type of therapy, as do dyspareunia and sterility. Ovarian extracts to be efficacious must be given intravenously, as other methods are useless. The hypophyseal hormone should be given intramuscularly. Calcium therapy is a valuable adjuvant due probably to its effect upon the sympathetic nervous system.

RALPH A. REIS.

Sevringhaus and Thornton: Treatment of Sexual Immaturity with Concentrated Preparations from Pregnancy Urine, Endocrinology 17: 123, 1933.

Treatment was given to 23 women who had been demonstrated to be sexually infantile, or had had long periods of amenorrhea or oligomenorrhea. Concentrated preparations from human pregnancy urine (follutein and antuitrin-S) were found to stimulate at least 10 patients to more regular and copious menstruation. The results were doubtful in 7, negative in 6 others. Hirsutism in 14 of these women was not relieved.

J. THORNWELL WITHERSPOON.

Schaefer and Brosius: Menopausal Epilepsy, Endocrinology 17: 133, 1933.

The chemical analysis of blood and urine proves that very often an incretory imbalance is present during the menopause. Zondek states that at this time there is an excess of pituitary sex hormone, while Kurzrock's work shows that there is a lack of theelin, and that when this lack can be demonstrated, theelin administration will yield excellent therapeutic results. A case is described in which attacks with the clinical appearance of true epilepsy started six months after cessation of menstruation at the age of forty-eight years. Various gland extracts were used for five years without relief. Theelin has completely relieved the attacks.

J. THORNWELL WITHERSPOON.

Roffo, Luigi: Thyroid Function and Abortion, Folia Gynaec. 30: 233, 1933.

Guinea pigs were thyroidectomized or treated with thyroxin at various periods of pregnancy. During the early months thyroid deficiency had no effect upon the pregnancy, but during the latter months may cause its interruption. Thyroxin administration frequently caused an interruption of pregnancy.

J. M. PIERCE.

Hoffmann: Isolation and Demonstration of Parathyroid Hormone in the Blood of Pregnant Women, Arch. f. Gynäk. 153: 181, 1933.

Hoffmann reports a number of clinical and experimental observations which indicate an increased activity of the parathyroid glands during pregnancy. He attempts to demonstrate an increased amount of parathyroid hormone in the blood stream during pregnancy by means of a newly devised method. It consists in separating the active substance from the serum protein bodies by boiling with dilute hydrochloric acid followed by filtration. The solution is then treated with a dilute acetone solution and precipitated by dilute trichloroacetic acid. The dried residue is neutralized and dissolved in normal saline. One hundred cubic centimeters of blood plasma should yield 20 mg. by this method.

The material obtained was tested on dogs by noting the effect on the blood calcium. When drawn late in pregnancy, there results a marked increase in blood calcium of dogs. The hormone was found present in the blood after the third month of pregnancy, increases slightly until the eighth month, followed by a marked increase during the last weeks of pregnancy. It decreases rapidly during the puerperium.

RALPH A. REIS.

Kulka, E.: The Posterior Pituitary Hormone in the Cerebrospinal Fluid and in the Milk, Monatschr. f. Geburtsh. u. Gynäk. 93: 348, 1933.

No oxytocic substances could be found in the spinal fluid of pregnant women and the author could not discover any connection between posterior pituitary hormones and the secretion of milk.

J. P. GREENHILL.

Möhle, R.: Hormonal Loosening and Separation of the Symphysis Pubis in the Nonpregnant Guinea Pig, Zentralbl. f. Gynäk. 57: 391, 1933.

Castrated, and noncastrated virginal female guinea pigs, in addition to a few castrated and noncastrated male guinea pigs, were given 14 daily subcutaneous injections of various hormone preparations. The condition of the symphysis pubis was established by palpation, roentgenography, and by macro- and microscopic section. It was found that corpus luteum hormone, alone, did not give definite widening

of the symphysis, neither did folliculin, preglandiol, yohimbin or sesam oil. Folliculin used on virginal castrates gave a fairly definite separation of the symphysis. Corpus luteum, when used in conjunction with folliculin, however, gave such definite separation of the symphysis that the animals could not be distinguished, on this basis, from pregnant animals. The author concludes that the specificity of corpus luteum as the sole factor in the relaxation of the guinea pig symphysis must be challenged.

WILLIAM F. MENGERT.

Hashimoto, Hiroshi: So-called Anterior Pituitary Hormone Content of Cerebro-spinal Fluid, Zentralbl. f. Gynäk. 56: 2247, 1932.

Spinal fluid, usually obtained at operation, from 20 patients with various diseases was injected into immature female white mice according to the Aschheim-Zondek technic. It was found: (1) The anterior pituitary hormone could not be demonstrated in patients with uterine or adnexal tumors or uterine malpositions; (2) the hormone could be demonstrated in cases of normal pregnancy when more than 18 cm. of spinal fluid were used; (3) the hormone was clearly demonstrated in the spinal fluid of patients with mole, chorionepithelioma, and eclampsia, even when less than 16 c.c. of fluid were used.

WILLIAM F. MENGERT.

Schoeller, Dohrn, and Hohlweg: Swelling of the External Genitalia in Castrated Female Baboons After Oral and Hypodermic Treatment with Female Follicular Sex Hormone, J. Lab. & Clin. Med. 18: 926, 1933.

The question of a definite follicular hormone dosage in the human being is still a problem. To determine a suitable dose for the human being, tests were carried out on castrated female baboons because in these animals a visible external sign, viz., swelling of the vulva offers a method of estimating the effect of the follicular hormone. Furthermore, baboons are more closely related to human beings in character of the sexual cycle than is macacus rhesus. The female baboon has a fairly regular menstrual cycle which is accompanied by monthly bleeding; the cycle lasts approximately thirty days. The characteristic swelling in the genital region and perineum reaches its maximum at the time of ovulation.

These authors' experiments show that the peroral administration of 6,000 to 8,000 rat units of progynon spread over a period of eight days produces the genital swellings characteristic of heat in the castrated female baboon. With subcutaneous injection of crystalline follicular hormone dissolved in oil 2,000 rat units spread over a period of eight days produced the same effect, while the same dose given in a single injection is inactive. Where progynon benzoate is used, a single injection of 2,000 rat units is sufficient to produce a definite reaction. These investigations further show that with a suitably chosen product and tablets of a particular composition, the peroral dose is four to five times greater than the parenteral dose.

W. B. SERBIN.

De Fermo: The Hypophysis and Malignant Tumors. The Aschheim-Zondek Reaction in Blastomas, Arch. ital. di Chir. 33: 801, 1933.

The Aschheim-Zondek reaction was studied in 72 patients who had malignant tumors of genital and extragenital origin. The reaction was constantly negative for Prolan B, and positive in 43 per cent of all cases for Prolan A. In patients with tumors of genital origin the reaction for Prolan A was positive in 71.8 per cent; in those of extragenital origin in 20 per cent. The reaction was always negative in benign ovarian cysts, but positive for Prolan A in 42.8 per cent of uterine fibromyomas.

The author concludes that the presence of Prolan A is the expression of hyposexual function causing an increase in the activity of the anterior pituitary hormone.

JAMES M. PIERCE.

Ware, H. H., and Main, Rolland J.: Observations on the Accuracy of the Rabbit Ovulation Test for Pregnancy, J. Lab. & Clin. Med. 18: 254, 1932.

To test the efficiency of the rabbit ovulation reaction for pregnancy these authors employed the test only in those cases in which the diagnosis of a possible pregnancy was imperative, but doubtful according to the usual means of examination. This, it seemed, would be a more rigorous and valuable test of the method than the indiscriminate application of it to cases easily diagnosed by other procedures.

Specimens were obtained from 150 patients with "follow-ups" on 100 until the presence or absence of pregnancy could be proved. Of these 100 women, 63 gave a positive reaction, i.e., were pregnant; 6 of these were twelve days beyond an expected but missed period and 3 had tubal pregnancy. The negative cases consisted of ovarian cysts 2; tuboovarian abscess 3; tuberculous peritonitis 1; fibroid of uterus 2; missed abortion 1; patients in menopause 2. The authors feel that the test is 99 per cent accurate and offers great advantage in diagnosing hydatidiform mole, missed abortion, ectopic pregnancy, fibroids, menopause and tuboovarian abscess. The earliest pregnancy diagnosed was six days after a missed period. Following delivery negative results are obtained in from twenty-four to seventy-two hours.

W. B. SERBIN.

Hamburger: Excretion of Prolan in the Urine of Old Women, Klin. Wehnschr. 12: 934, 1933.

In a series of women well past the menopause the author found prolane in the urine in 75 per cent of the cases. This corresponds almost exactly to the frequency with which prolane is found in the urine following castration, namely 73 per cent. The author also mentions the fact that he found prolane in the urine of 79 per cent of castrated men.

RALPH A. REIS.

Fluhmann: Comparative Studies of Gonad Stimulating Hormones, Endocrinology 17: 550, 1933.

The present study is a comparison of the results obtained in five-day experiments from the administration to immature rats of acid extracts made from sheep anterior pituitary glands and blood of pregnant women. The chief differences in the effects obtained were: (1) The pregnancy blood extract stimulated a greater increase in uterine weight at all doses; (2) at comparable "luteinization" doses the anterior pituitary extract produced a much greater increase in the weight of the ovaries; (3) the histologic picture of the ovaries produced by the two extracts differed from one another, but remained constant for each preparation at all doses, which resulted in an increase in ovarian weight. In the case of the animals receiving the anterior pituitary preparation, the ovaries were characterized by the presence of a large number of corpora lutea and many atretic follicles, while when pregnancy blood extract was given they contained corpora lutea, lutein cysts, developing graafian follicles and only occasional atretic follicles.

It is believed that these differences suggest that the ovary stimulating hormone found in the blood of pregnant women is not identical to that occurring in the anterior hypophysis of sheep. On the other hand, certain indefinite factors in the

test animals and the possible presence of other hormones in the extract make a true interpretation of the exact significance of these differences impossible at the present time.

J. THORNWELL WITHERSPOON.

Werner and Manguio: Antagonism Between Insulin and Pituitrin, Klin. Wchnschr. 12: 748, 1933.

Literature shows repeated statements that insulin and pituitrin are antagonistic in their action upon carbohydrate metabolism and upon the blood sugar, but the authors were able to demonstrate such an antagonistic action only if the insulin was administered subcutaneously. Even then the results were not uniform. Pituitrin showed no effect when the insulin was given intravenously. It is therefore impossible to conclude that insulin and pituitrin are antagonistic in their effect upon carbohydrate metabolism. When such an effect is noted, it must be due to changes in the insulin following its absorption from the subcutaneous tissues or to a stimulation of adrenal secretion.

RALPH A. REIS.

Del Castillo and Lanari: Galactorrhea, Amenorrhea and Acromegaly, Semana méd. 31: 303, 1933.

The author reports a case of galactorrhea, amenorrhea, and acromegaly in a woman of twenty-seven years of age. Never pregnant; menarche at fourteen.

For the past three years steady enlargement of hands and feet; headaches in back of the neck or in temporal regions, always worse during menstruation; for five months menses very scant and for past two months no menstruation. Since the onset of symptoms many fine hairs have appeared on arms and legs.

Examination showed a typical case of acromegaly with hirsutism. There was milk in the breasts similar to a lactating woman. External genitalia normal; internal genitalia hypoplastic.

X-ray of the sella turcica showed it to be very deep and increased in all diameters. Friedman test negative. No folliculin in the urine.

Treatment: In fourteen days 6,900 units of folliculin hypodermically and 6,800 units by mouth. Total 13,700 units.

Result: On the fourth or fifth day there was some pain in the lower abdomen but no menstruation. The secretion of milk was not affected. The author believes that the lack of effect was due to: (1) Insufficient dosage of folliculin; (2) the folliculin actually depressed the sexual function of the anterior pituitary gland.

The author concludes that the syndrome of galactorrhea, amenorrhea, and acromegaly is due to a derangement of the anterior pituitary gland; folliculin develops and maintains the secondary sex characteristics.

J. M. PIERCE.

Sexton, D. L.: Headaches Associated with Endocrine Disorders, J. Missouri State M. A. 30: 393, 1933.

A headache which begins with the onset of menses and occurs regularly at menstruation, or the headache that is relieved only by pregnancy should be given an endocrine classification. Ovarian, pituitary, and thyroid disorders constitute the most common endocrine dyscrasias in which headache is an associated symptom.

The complaint of headache in the ovarian deficient individuals is definitely associated with the menses, occurring before, during, or after the period. The most common location is in the occiput radiating toward the shoulders. It may vary

in intensity from a dull ache to that of a boring nature. Upon administration of the follicular hormone hypodermically, these headaches show improvement of variable degree.

Pituitary headaches have no special characteristics which would relate them to the hypophysis. They simulate migraine more than any other type of headache in this group. Pregnancy may be the only thing that will relieve the headache. Because of the presence of large amounts of anterior pituitary-like hormone in the urine during pregnancy, this would seem to be an important link in the diagnosis of pituitary headache. In treating such cases the plan is to administer those hormones that are increased in the body during pregnancy.

Headache associated with symptoms of mild hypothyroidism in the absence of other etiologic factors is considered of the exhaustive type, and relief can be reasonably expected by thyroid therapy.

While ovarian, pituitary, and thyroid disorders have been discussed singly, two or more glands are often involved in the same individual.

J. THORNWELL WITHERSPOON.

Hofbauer, J.: A Warning in the Therapeutic Use of Anterior Pituitary Preparations, Zentralbl. f. Gynäk. 56: 1032, 1932.

Following some experiments in which 4 transplantations of fresh beef pituitary were done in one week on an ovariectomized adult guinea pig, the animal died suddenly. Examination of its organs revealed the fact that heart and kidneys were tremendously enlarged, also liver and spleen were affected, but not so markedly. Similar findings have been noted for the dog by Putnam and Teel. The author concludes with the warning that one must be reserved in the continued use of an anterior pituitary preparation which contains the growth hormone, especially when there is deficient ovarian activity. Pregnancy urine does not contain this principle, but placental extracts may, and one should have exact information concerning such extracts before employing them for long periods of time.

WILLIAM F. MENGERT.

Schmidt and Anselmino: Criticism of Ovarian Therapy, Ztschr. f. Geburtsh. u. Gynäk. 103: 47, 1933.

All commercial follicular hormone preparations are procured from the urine of pregnant human beings and animals, and therefore contain only that follicular hormone which produces the Allen-Doisy test. They all are devoid of the metabolism-stimulating hormone which is present only in the ovarian follicles themselves. Injections of these preparations can, therefore, affect only the uterus and endometrium; they can never be regarded as substitutes for complete follicular activity. The writer feels that the old whole ovarian preparations might be more effective in endocrine and menopausal disturbances because of the presence of all constituents of ovarian follicular activity.

GROVER LIESE.

Morkane: Backache in Women (Gynecological), New Zealand Med. J. 32: 62, 1933.

The author stresses the importance of differential diagnosis. Surgical treatment for a pelvic lesion should not be adopted until all orthopedic and medical causes of the ache, especially spinal, joint, and postural disturbances, are eliminated. Ache, above the lumbosacral region, is not due to pelvic disease. The presence of bleeding, leucorrhea, bearing-down pain in the lower abdomen, and also these symptoms with an ache becoming worse during or immediately preceding menstruation, does not necessarily mean that it is due to a gynecologic cause. In gynecologic cases the ache is usually diffused across the back, there are no tender spots, and the pain is not aggravated by movement. Its two main causes are: (1) retroflexion of the uterus, which usually results in congestion which, in turn, causes a pain which is central and sacral. A pessary should be tried to correct the displacement. If the symptoms are relieved and there is a recurrence after the withdrawal of the pessary, an operation can be advised. In genital relaxation there may or may not be any backache. A pessary should first be tried and if this fails, surgical treatment is contraindicated. (2) Pelvic inflammatory disease is another cause of backache, especially when such disease is accompanied by peritoneal adhesions to the posterior wall. A frequent cause of backache is posterior parametritis caused by a shortening of the sacro-uterine ligaments. If no backache is present when the cervix is lifted forward by the examiner's finger, then parametritis is almost certain not to be the cause of the backache. The electric cauterly often helps by reducing the size of a swollen cervix and removing infection. Tumors of the uterus and ovaries may lead to backache.

Differential diagnosis from benign and malignant tumors (especially carcinoma of the rectum), osteoarthritis of pelvic and hip joints, trauma, postural errors, referred pain (e.g., from constipation), pathologic changes in bones and joints is essential. The orthopedist and gynecologist must cooperate in their examinations of these patients.

F. L. ADAIR AND IRA BROWN.

Item

The American Board of Obstetrics and Gynecology announces that the next written examination and review of case histories for Group B applicants will be held in various cities of the United States and Canada, Saturday, November 3, at 2 P.M. For application blanks and further particulars apply to the Secretary of the Board, Dr. Paul Titus, 1015 Highland Building, Pittsburgh, Pennsylvania.